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Whitley

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(54) **UPWARD ACTING SECTIONAL DOOR WITH PINCH RESISTANT EDGE PROFILE BETWEEN DOOR PANELS**

(75) Inventor: **L. Blake Whitley**, Arlington, TX (US)

(73) Assignee: **Overhead Door Corporation**, Dallas, TX (US)

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(52) **U.S. Cl.** **160/201; 160/229.1; 16/225; 16/257; 16/267; 16/387**

(58) **Field of Search** **160/201, 229.1, 160/236; 16/225, 257, 267, 387**

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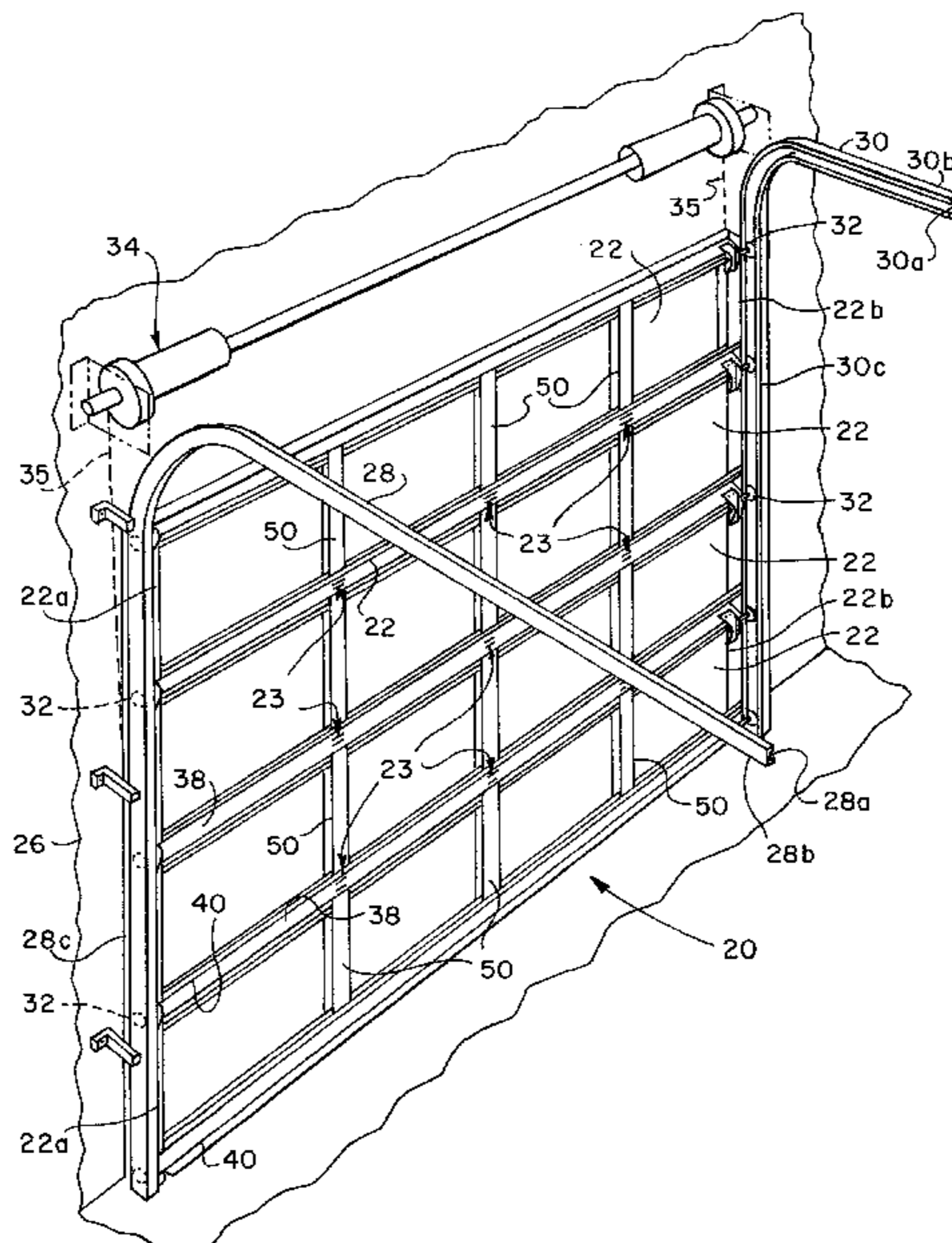
Primary Examiner—Blair M. Johnson

(74) *Attorney, Agent, or Firm*—Gardere Wynne Sewell LLP

(57) **ABSTRACT**

A sectional upward acting door includes interconnected door panels which are formed with generally planar outer and inner wall parts and upper and lower edges which cooperate to provide a pinch resistant joint between door panels when they are pivoted relative to each other. Spaced apart snap together hinge assemblies and snap in place guide roller support brackets may be used to assemble the door by moving the panels into assembly with each other between the door guide tracks. The panel edge profiles are formed by a convex surface on an upper edge of one panel and a cooperating concave multiple planar segment surface on the lower edge of the adjacent panel. An elongated seal strip may be secured in a groove in the lower edge of one panel and engageable with the apex of the upper edge of the adjacent panel. The panels are formed with inclined wall parts spaced inwardly of the pinch resistant edge profiles for supporting the hinge assemblies within a recess so that the hinge assemblies do not protrude inwardly of the generally coplanar inner wall parts of the panels. The hinge assemblies include opposed hinge plates with separate or integrally formed hinge pins on one hinge plate and the other hinge plate is formed with opposed elastically deflectable retainer tabs which allow the hinge pin to be snapped into a bearing bore in the other hinge plate to facilitate connecting the door panels to each other.

44 Claims, 15 Drawing Sheets



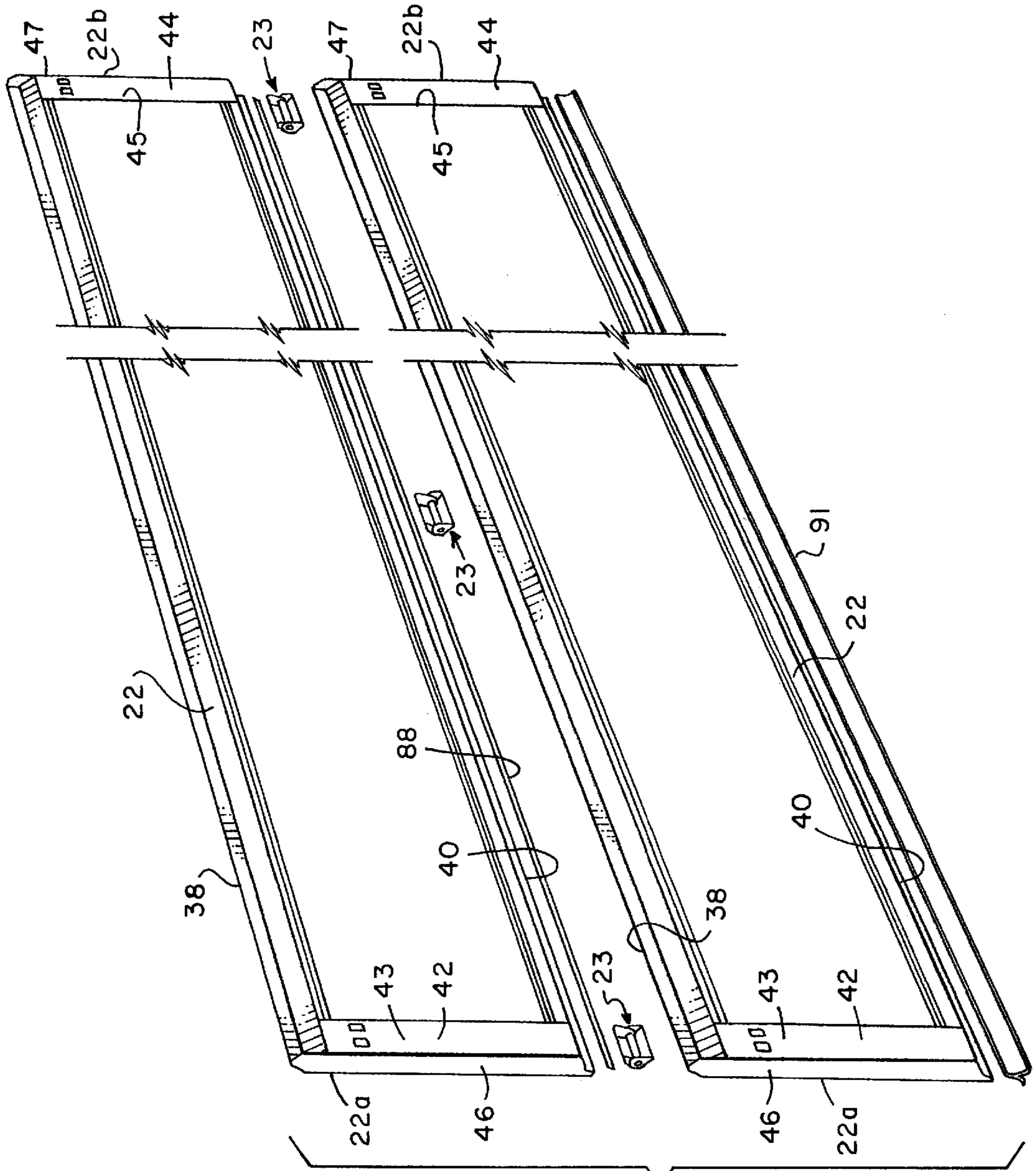
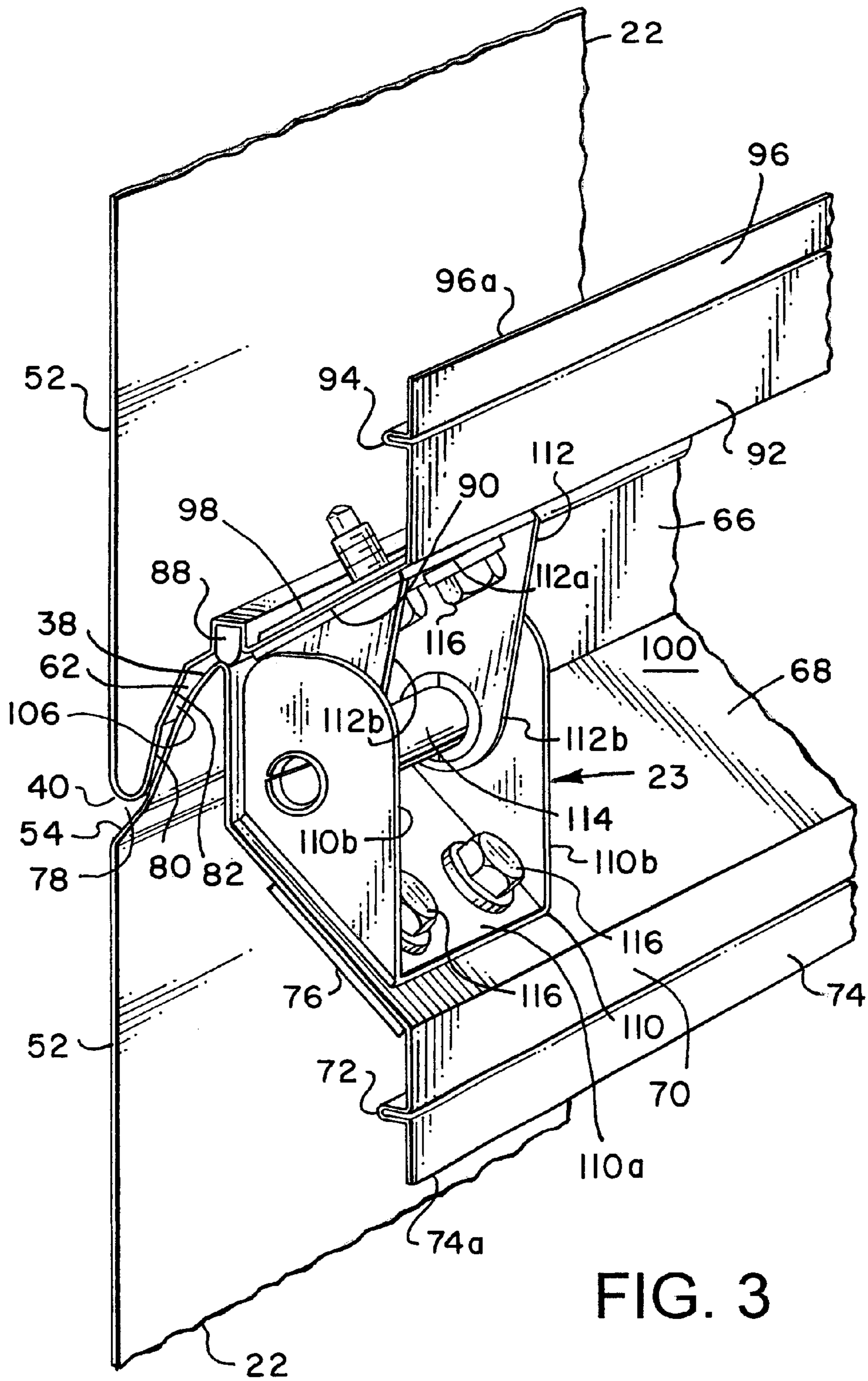


FIG. 2



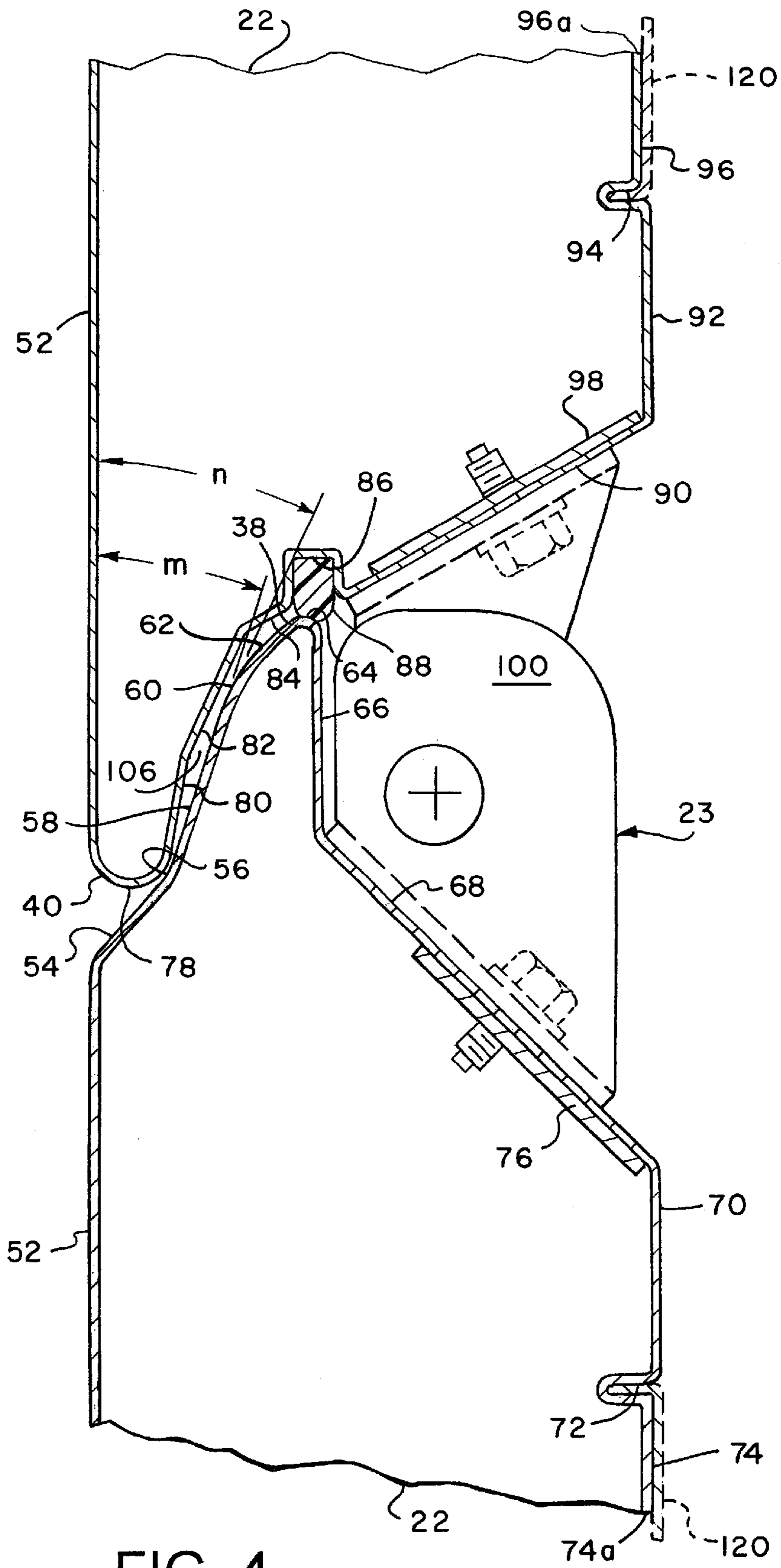


FIG. 4

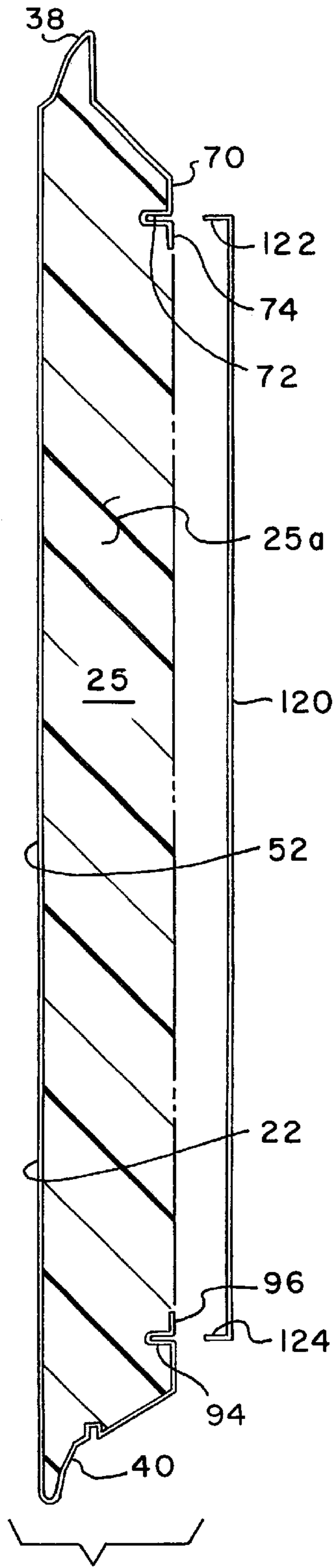


FIG. 5

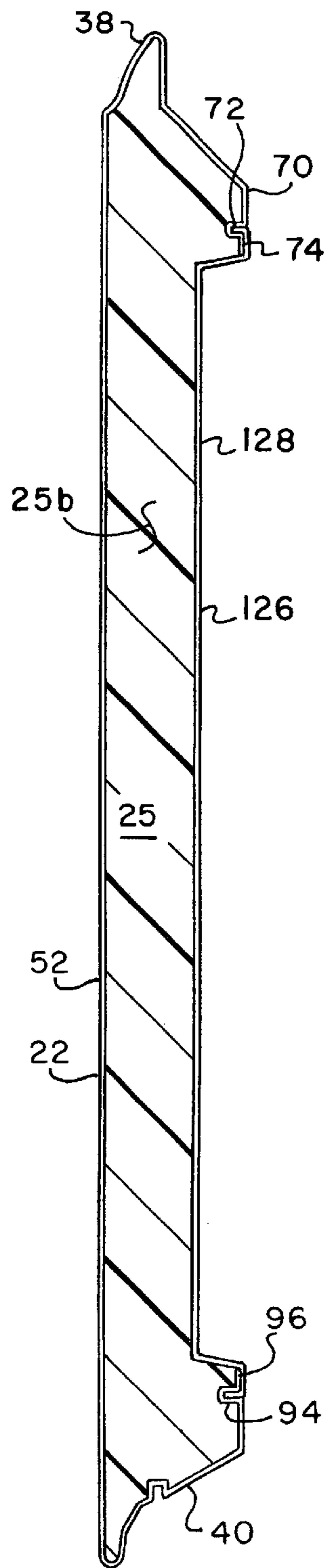


FIG. 6

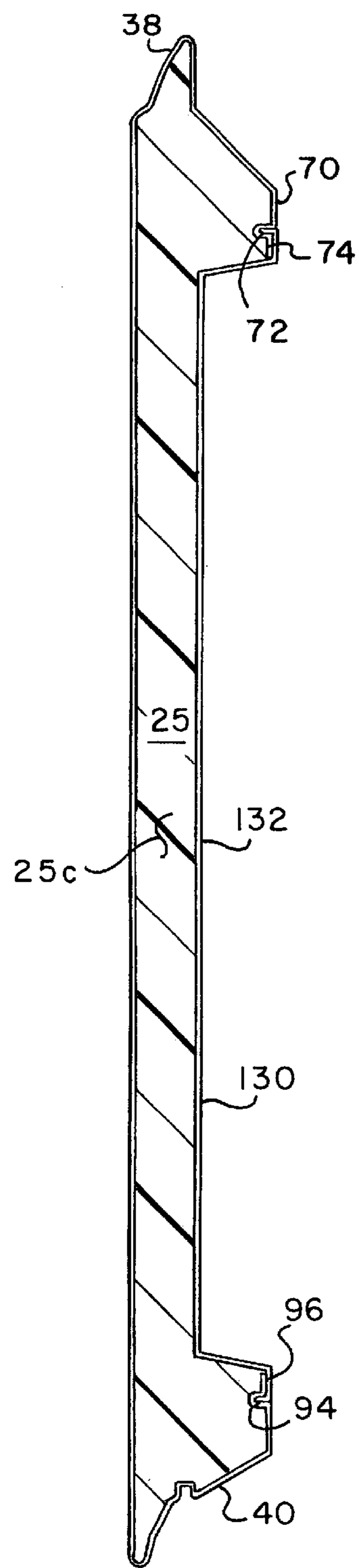


FIG. 7

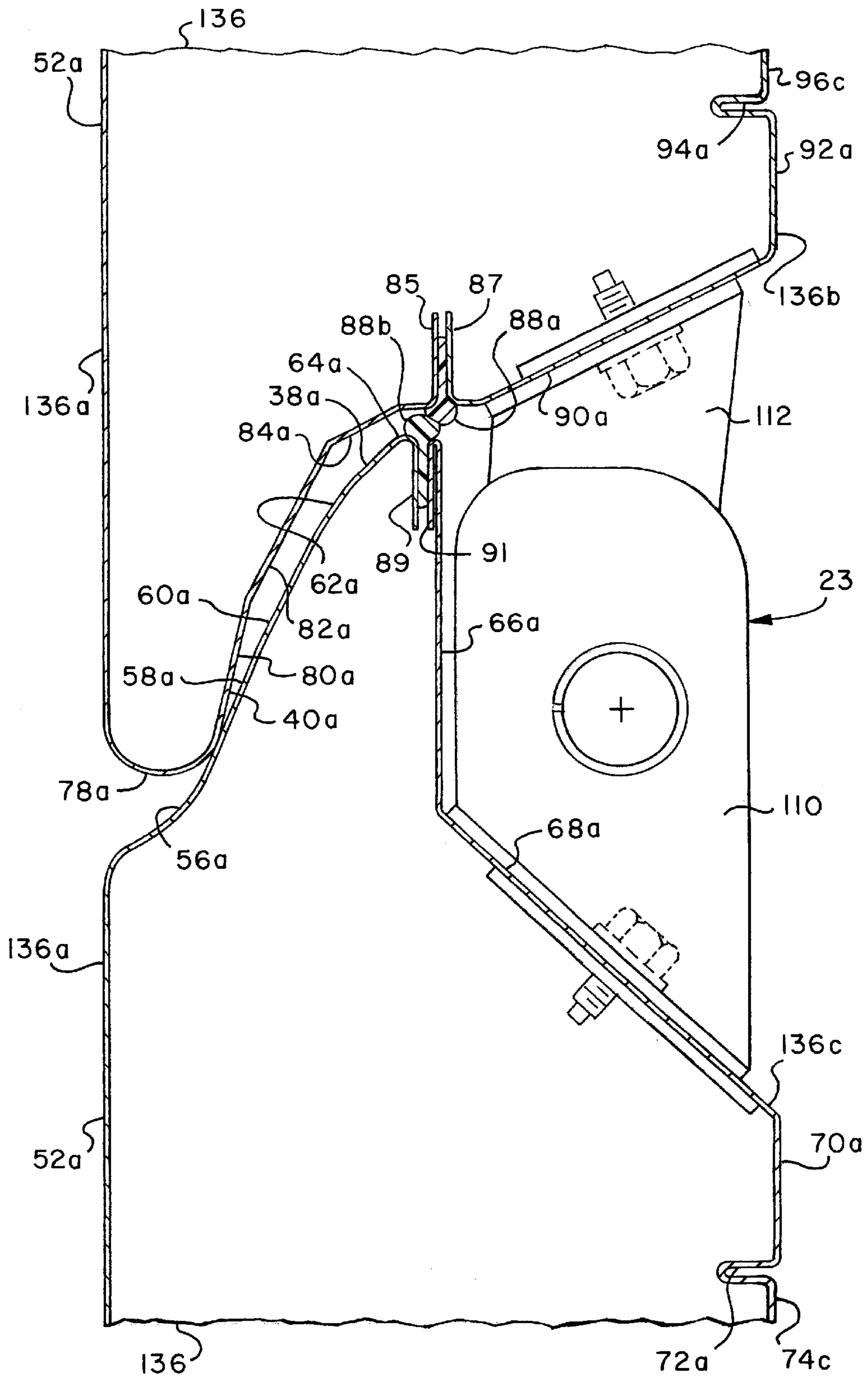


FIG. 8

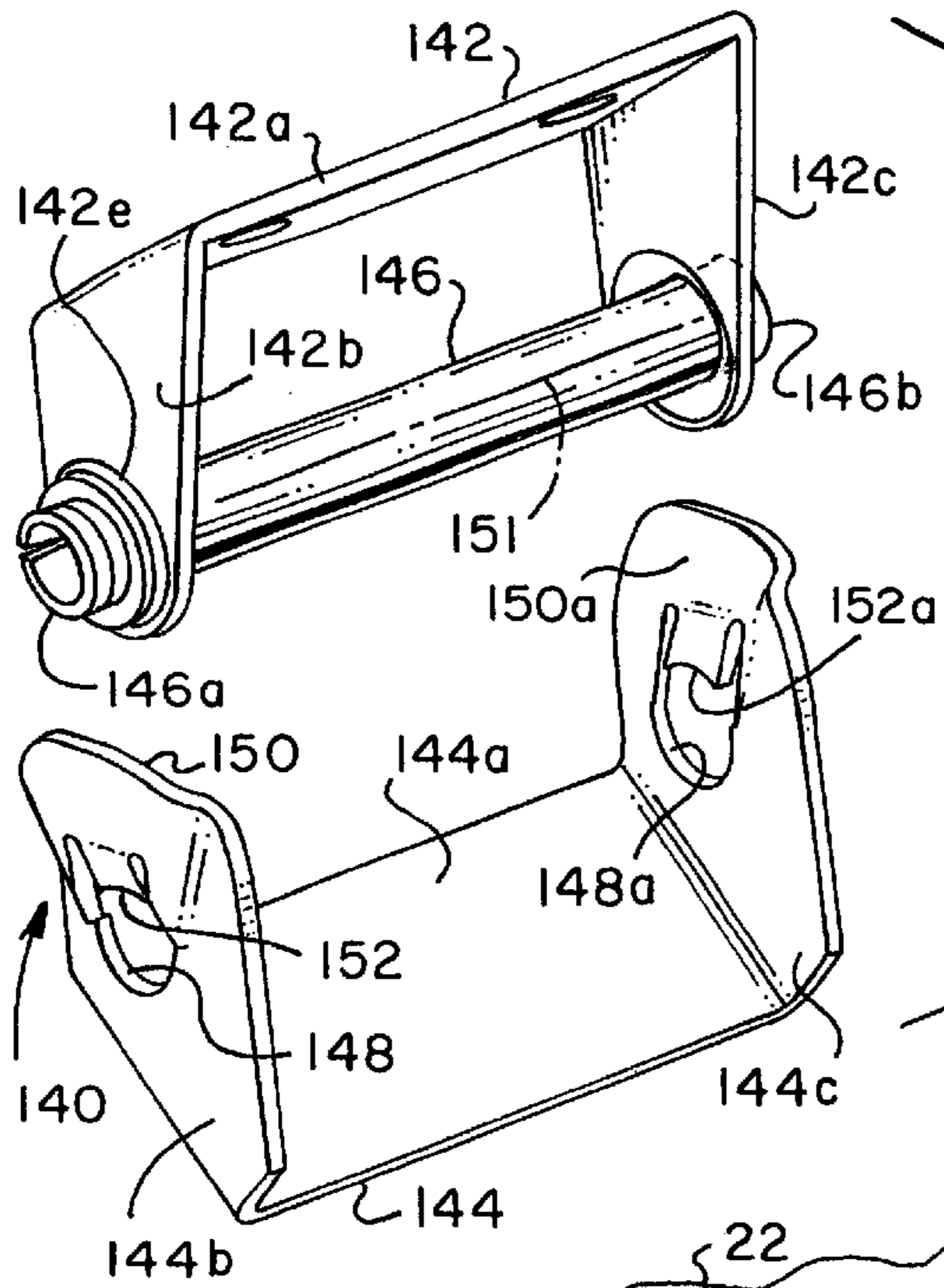


FIG. 9

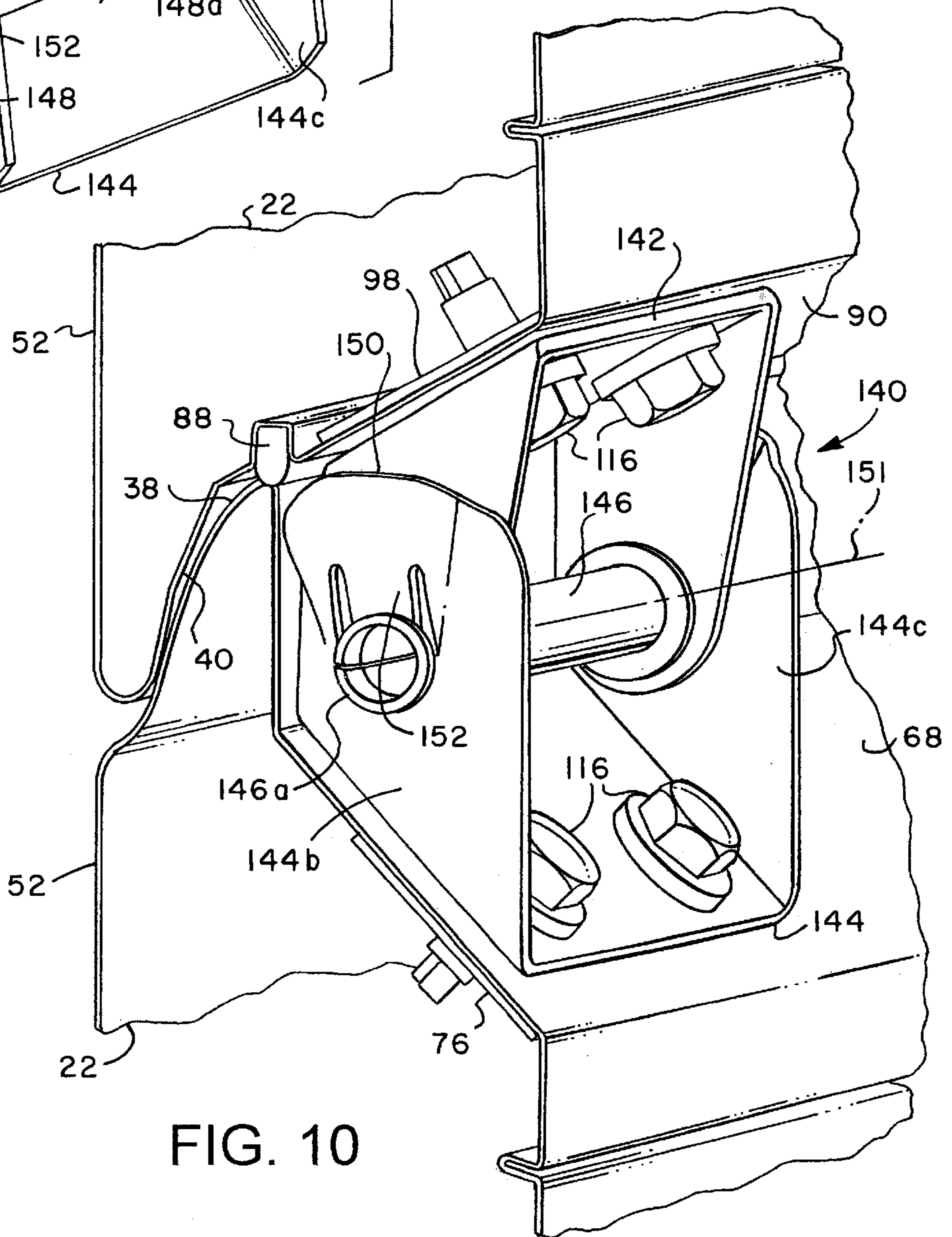
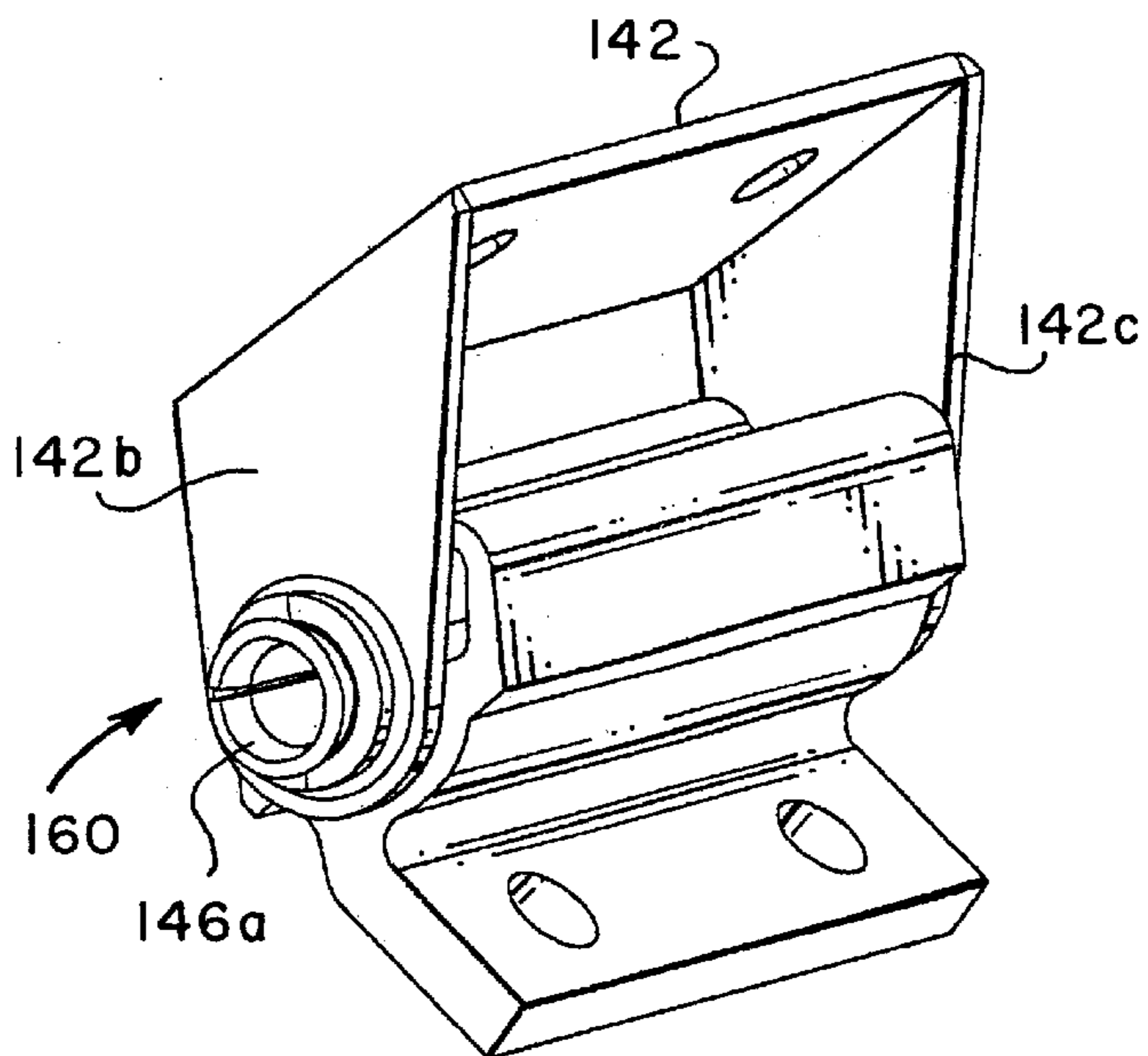
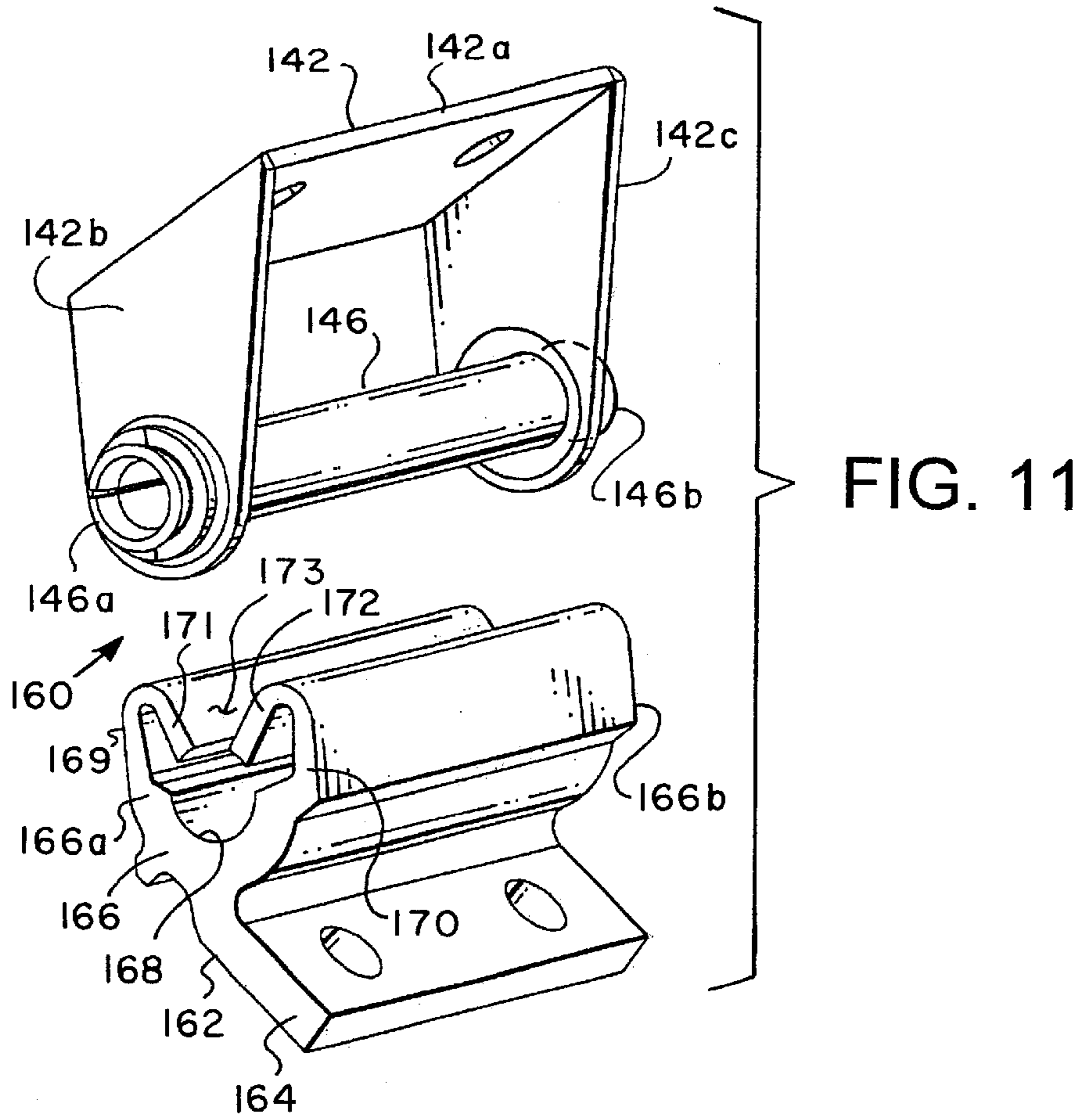


FIG. 10



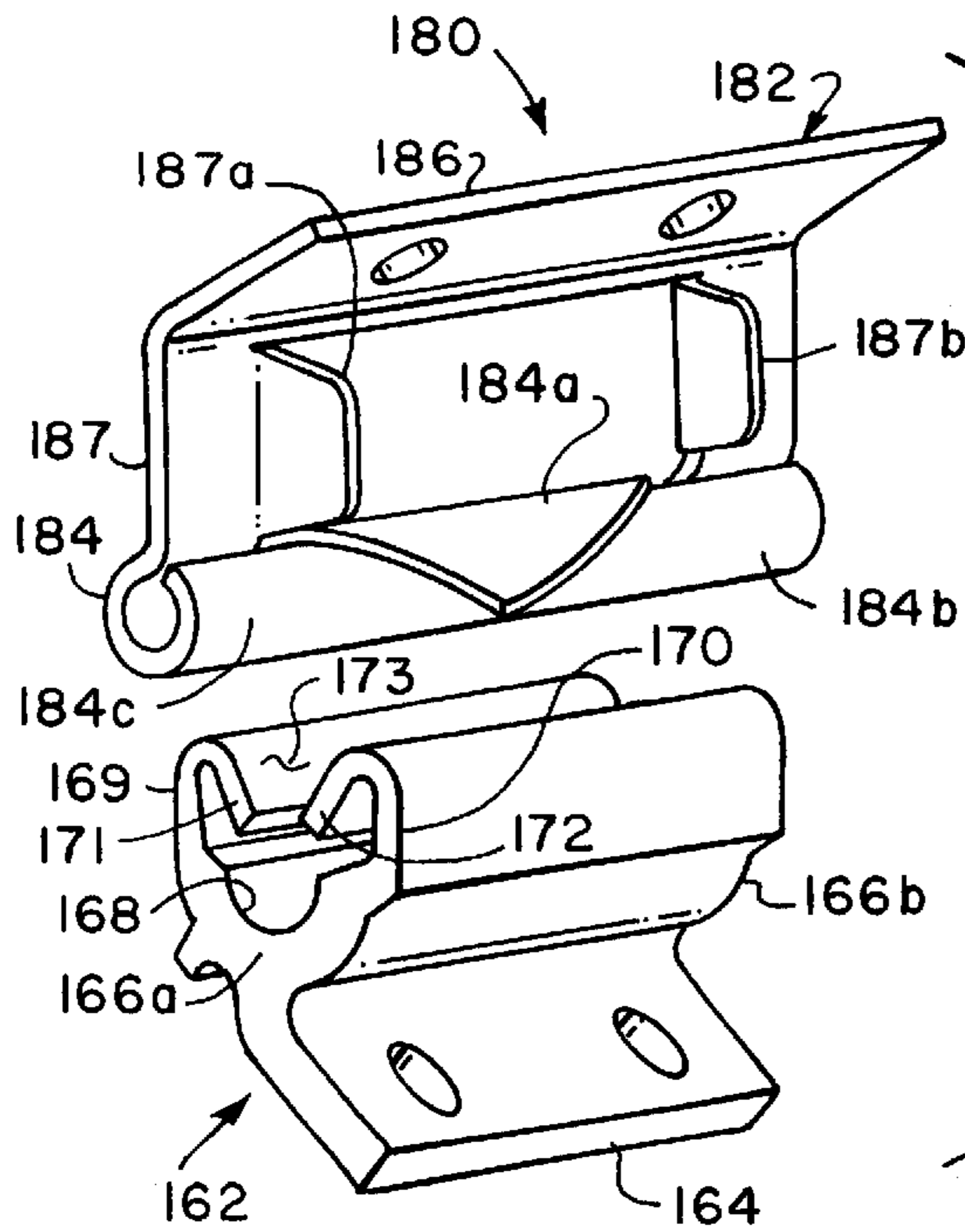


FIG. 13

FIG. 14

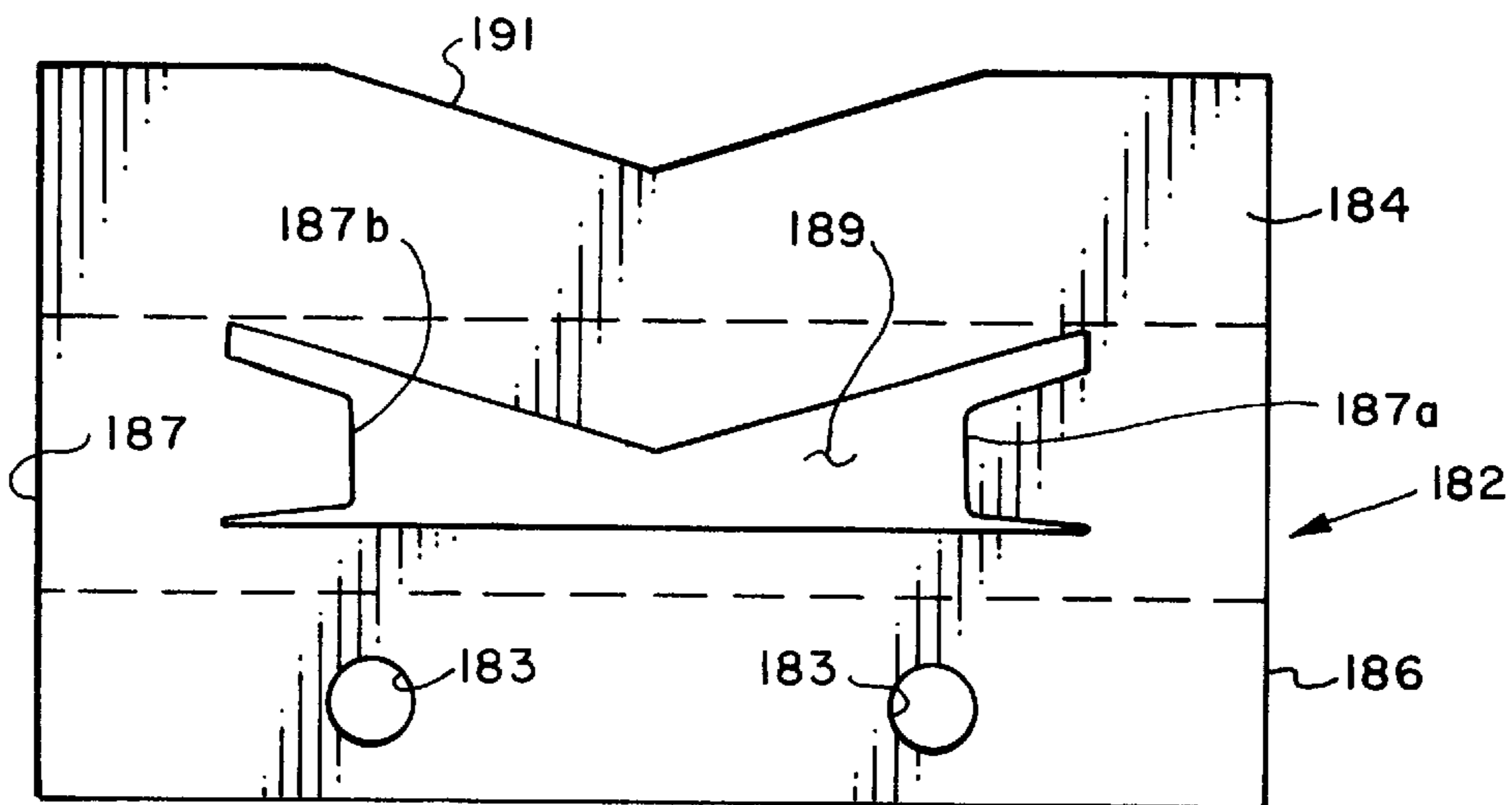
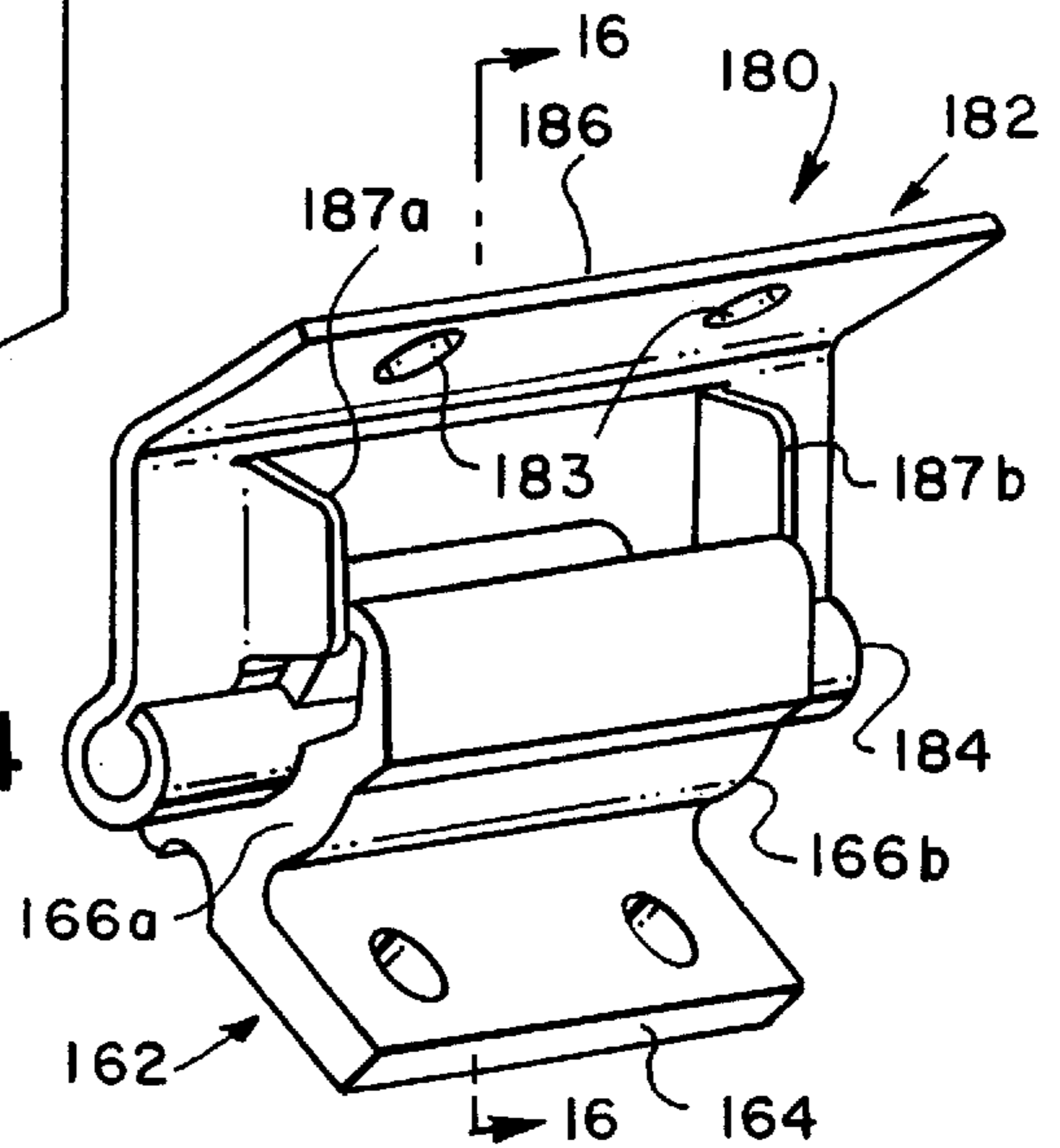


FIG. 15

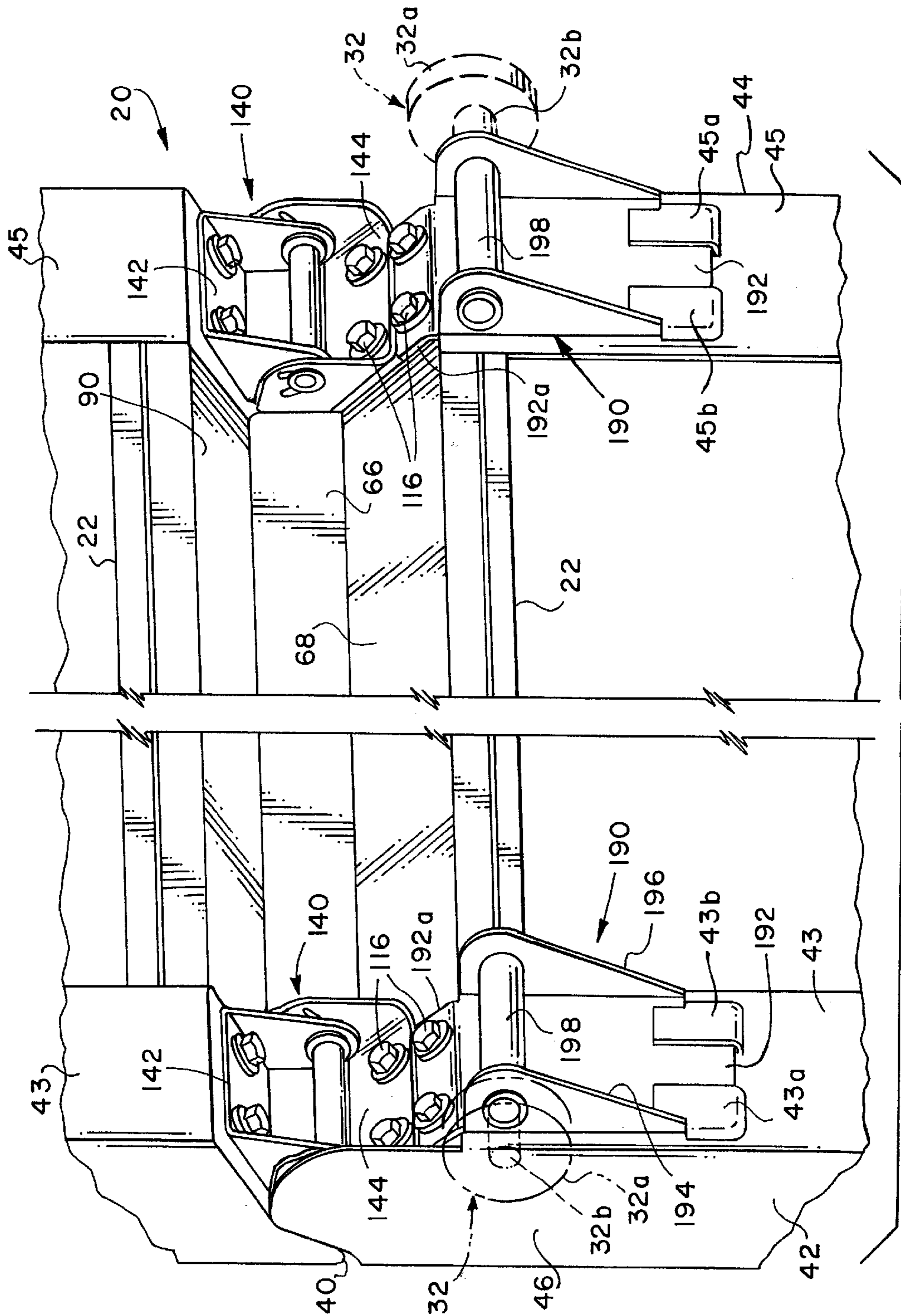


FIG. 17

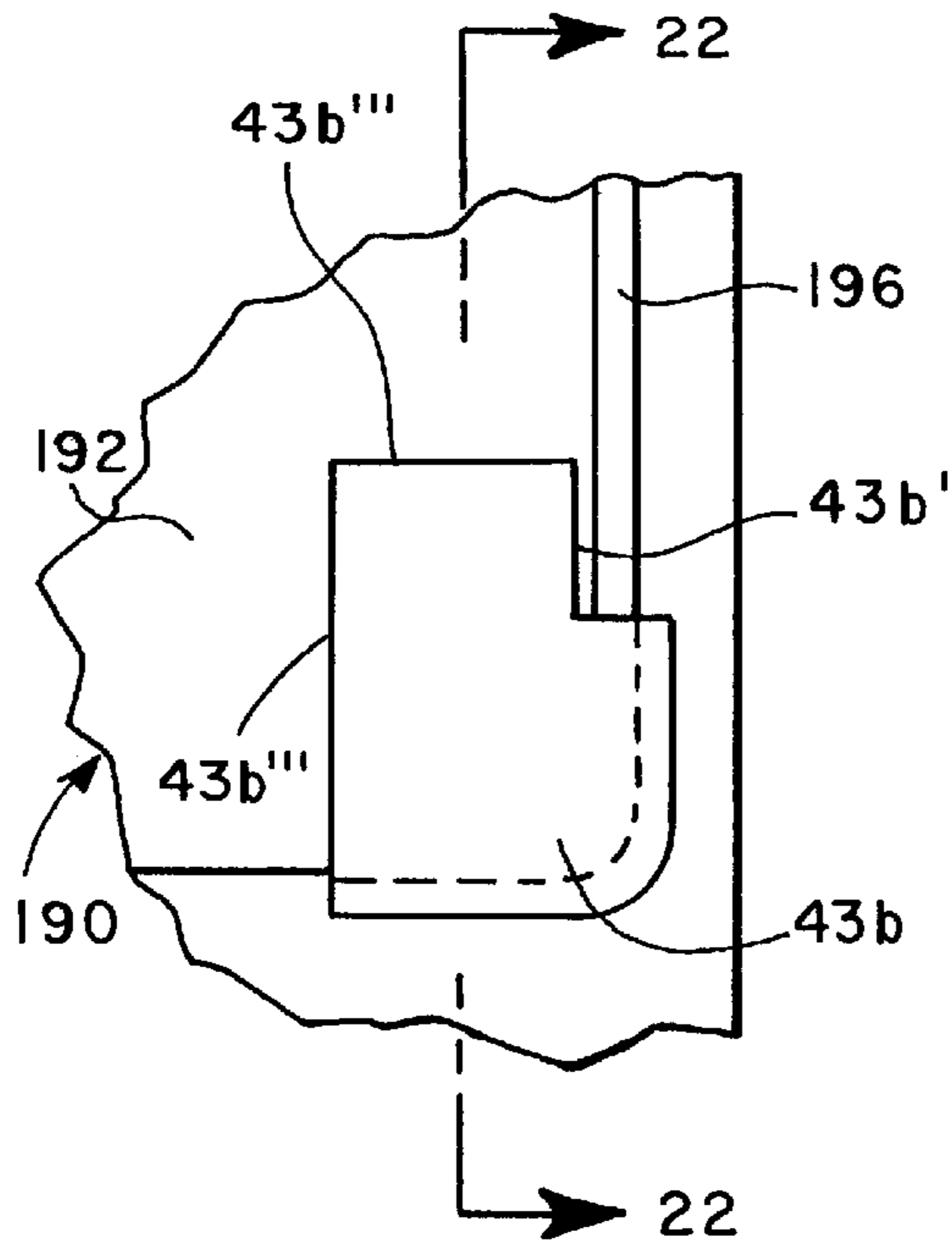


FIG. 20

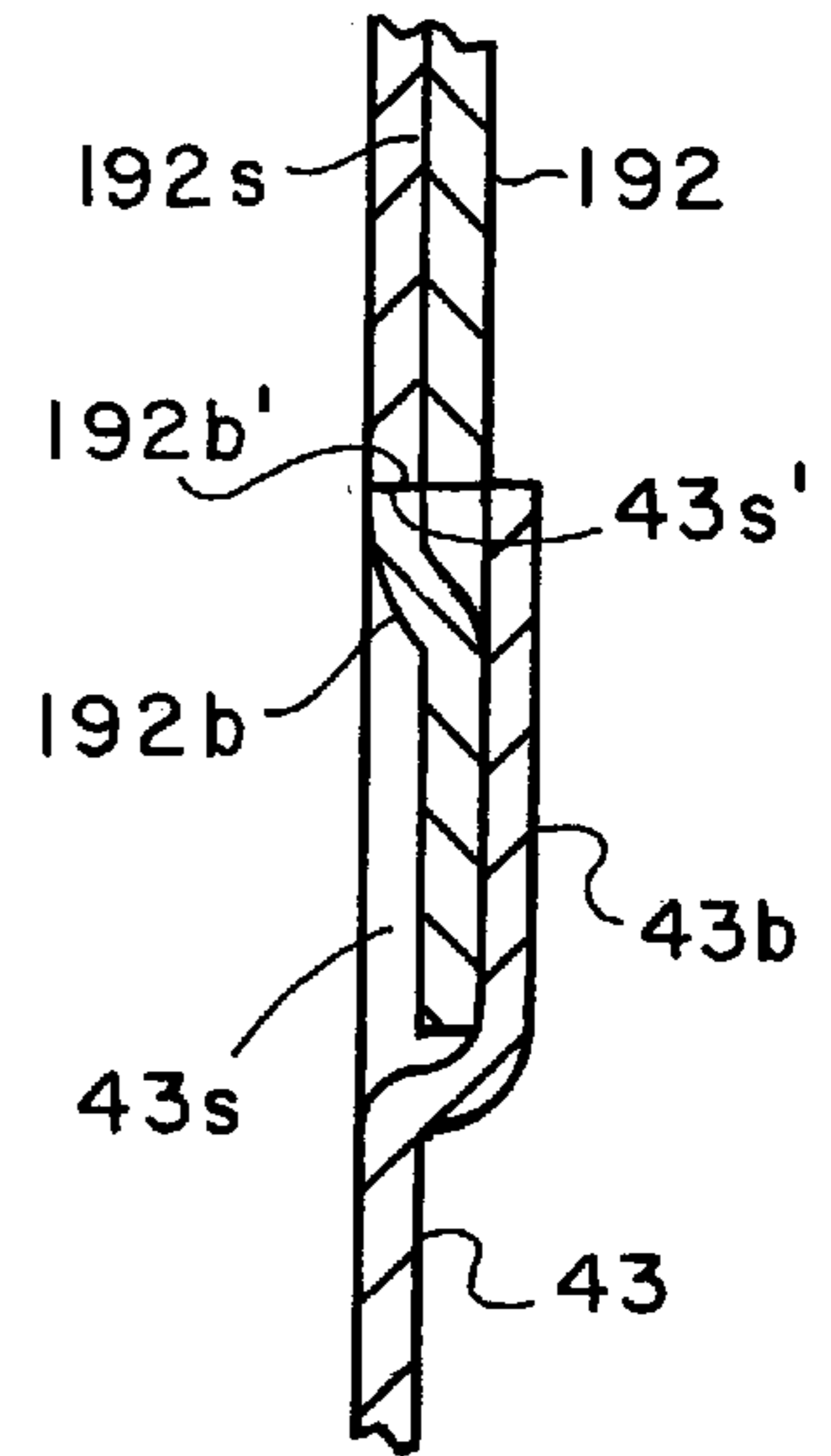


FIG. 22

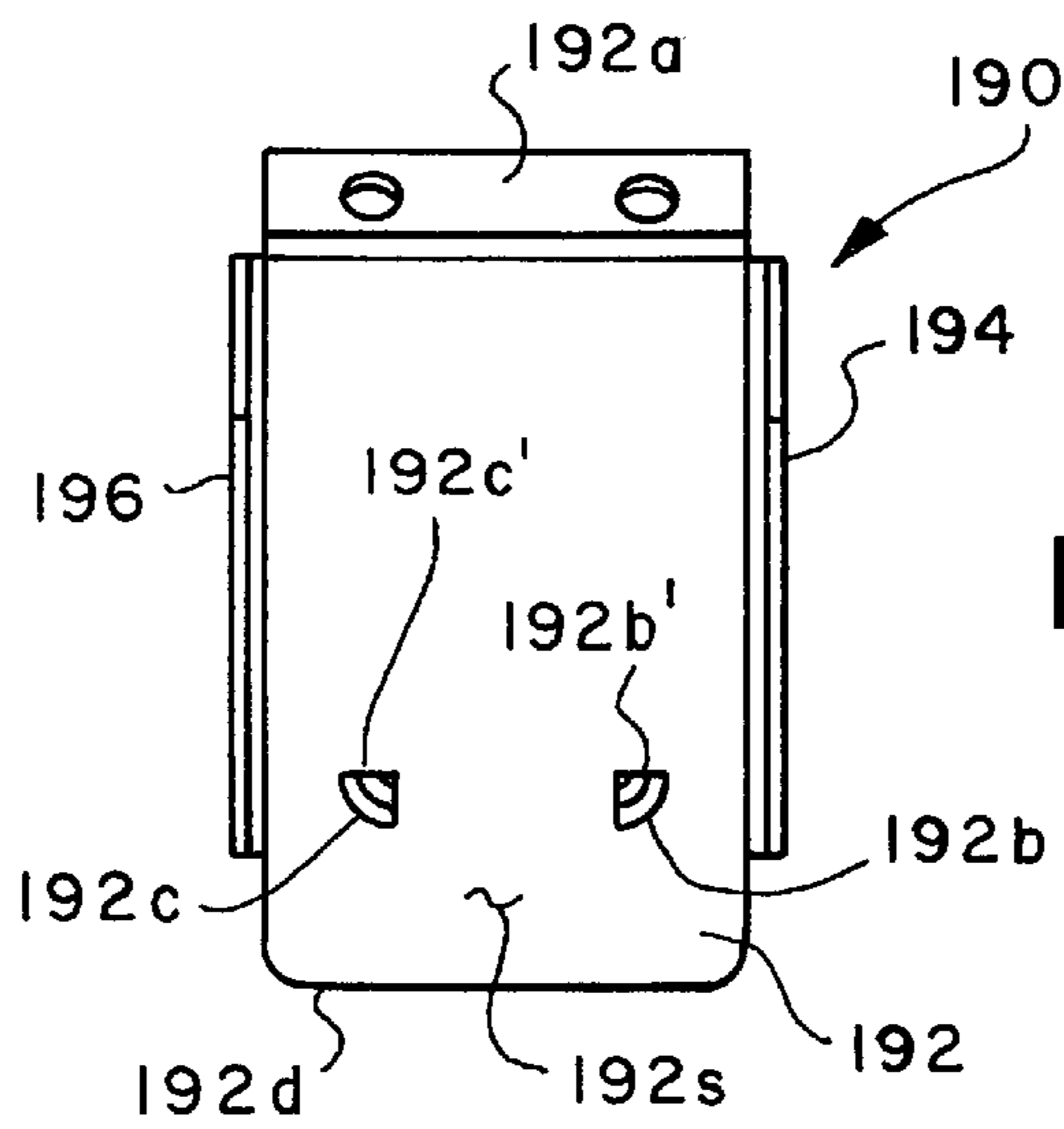


FIG. 21

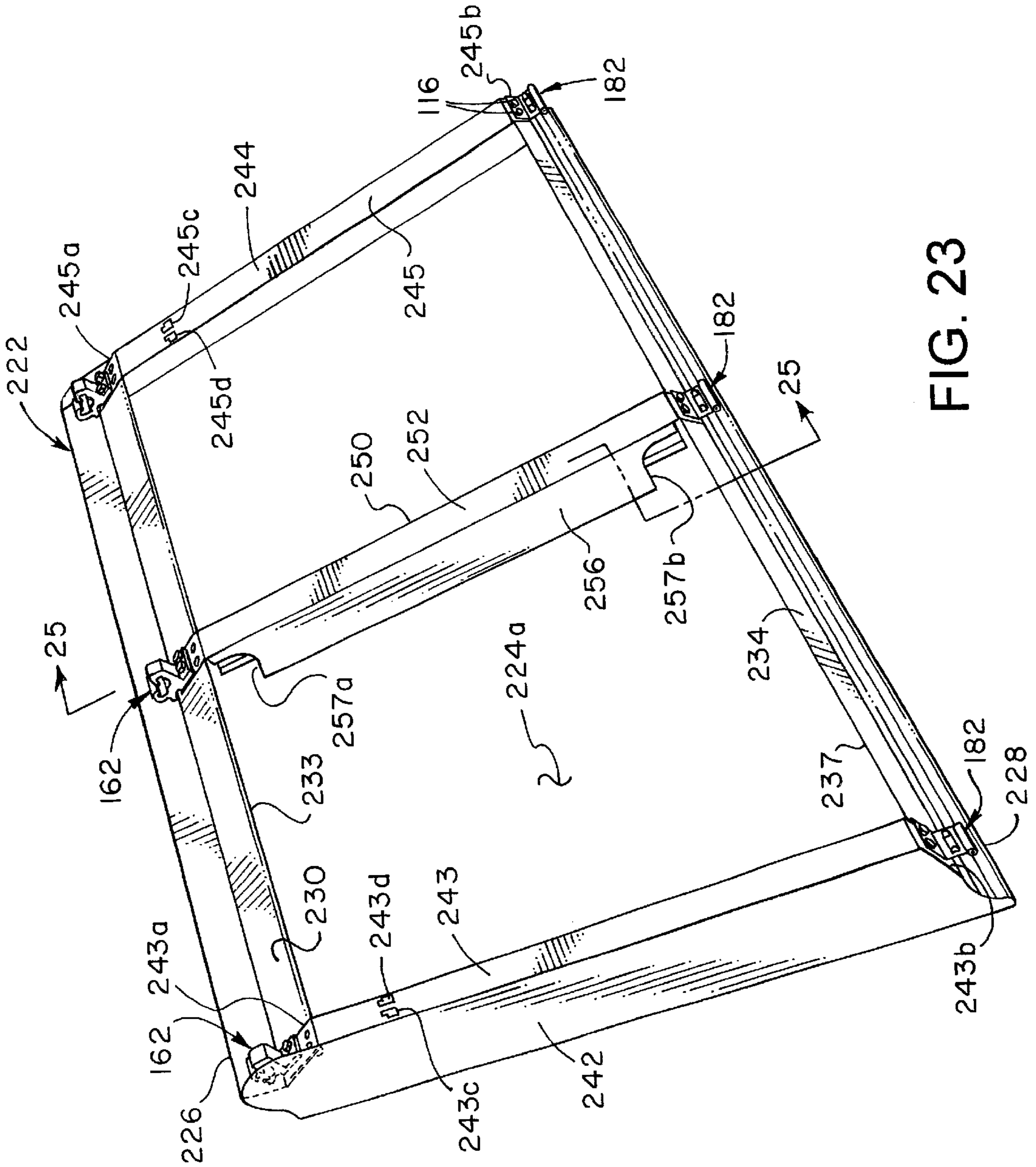


FIG. 23

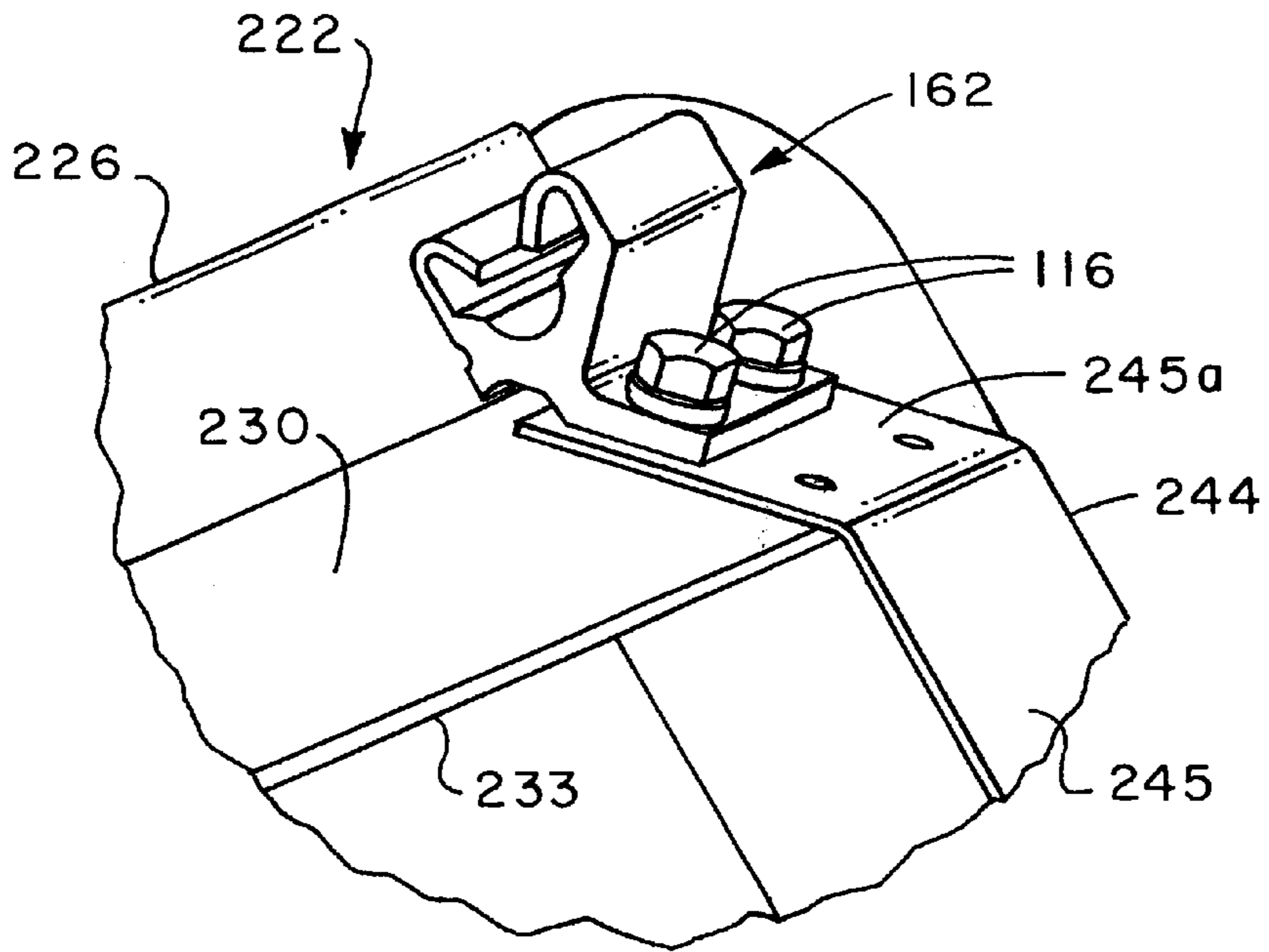


FIG. 24

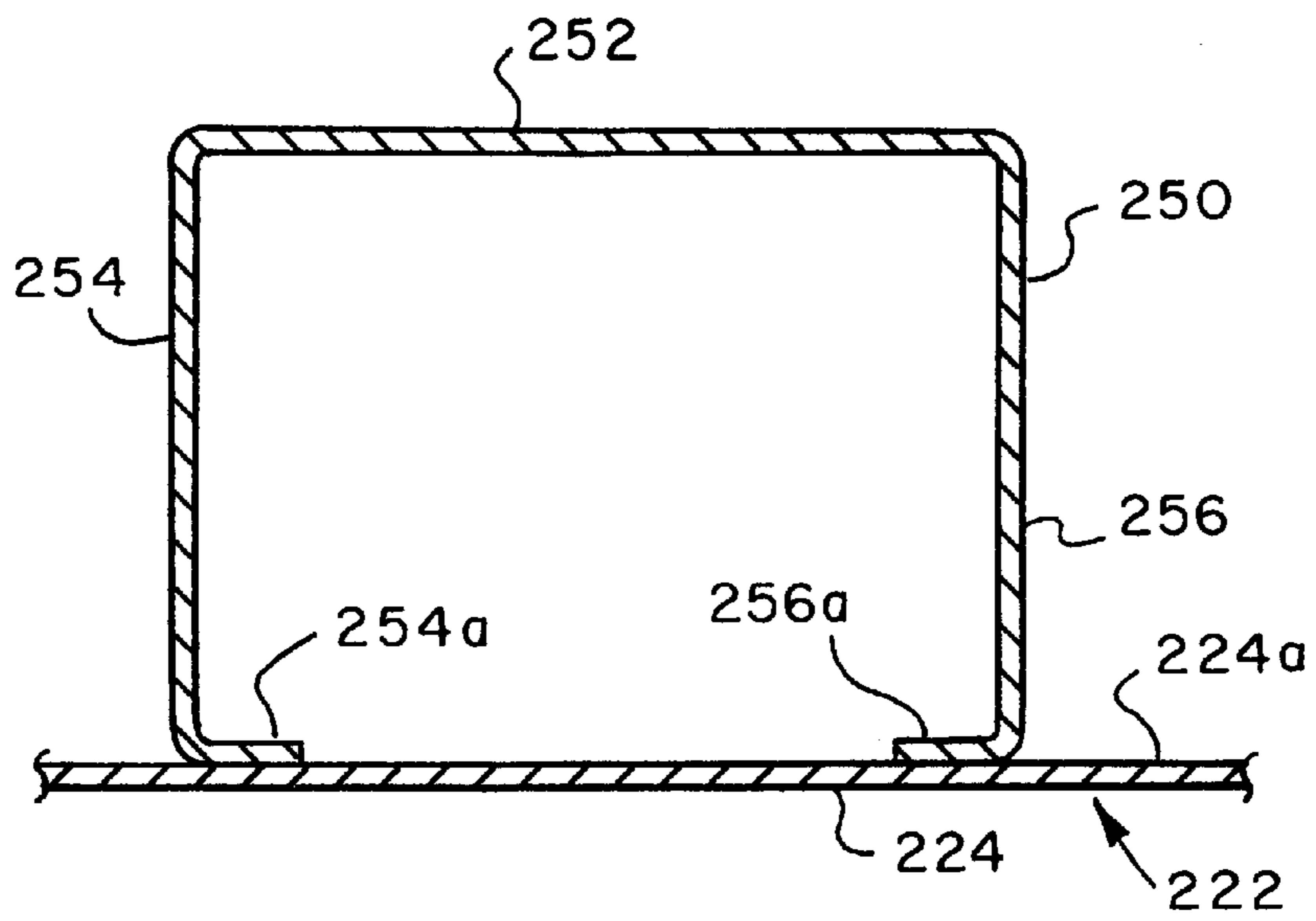


FIG. 26

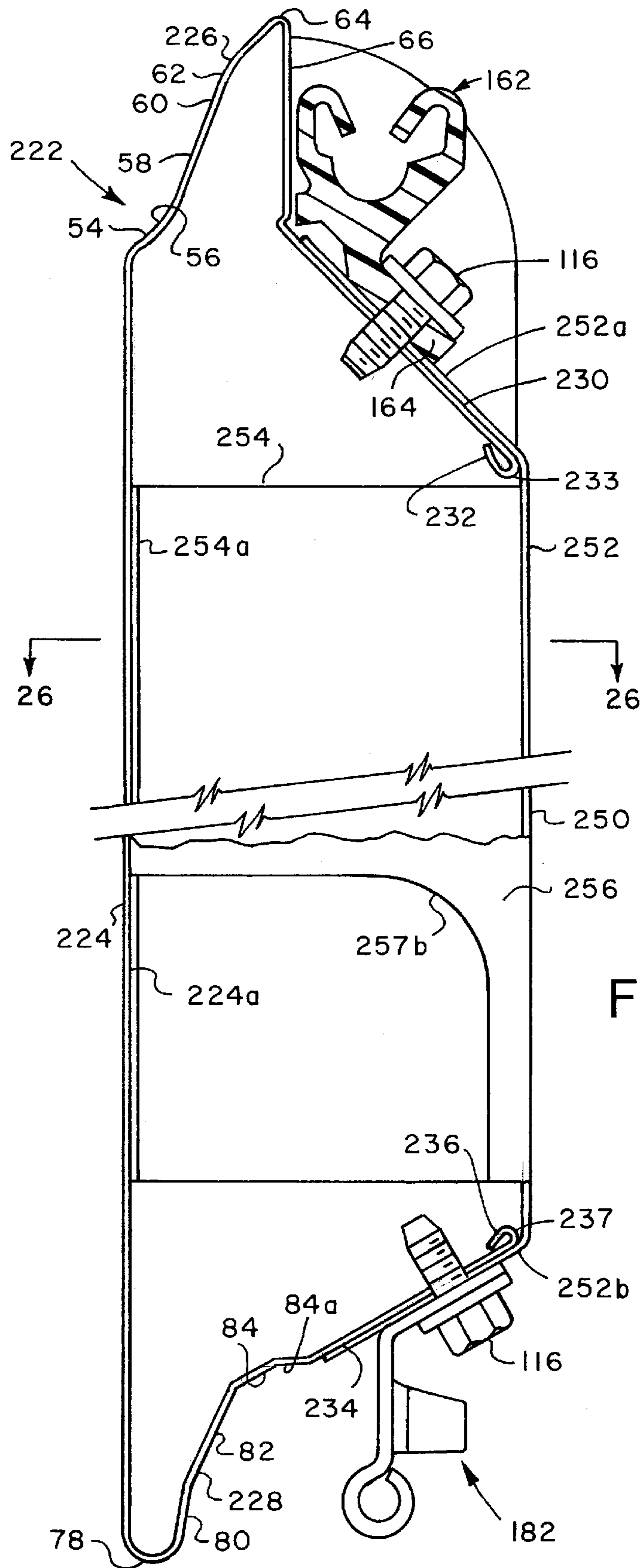


FIG. 25

**UPWARD ACTING SECTIONAL DOOR WITH
PINCH RESISTANT EDGE PROFILE
BETWEEN DOOR PANELS**

FIELD OF THE INVENTION

The present invention pertains to an upward acting multipanel or sectional door with pinch resistant edge profiles between the door panels and wherein the panels are interconnected by hinge assemblies which may be snapped together to facilitate assembly of the door.

BACKGROUND

Multipanel or so-called sectional garage doors and the like have been developed with panel edge profiles between adjacent door panels which are adapted to minimize pinching a person's fingers between the panels when the door moves to a closed position. Although various configurations of door panels with pinch resistant edge profiles are known in the prior art, there has been a continuing need to provide an improved sectional door construction wherein a pinch resistant edge profile is provided between adjacent door panels or sections while satisfying other desiderata in the construction, assembly and operation of multipanel or sectional upward acting garage doors, in particular.

One improvement which has been sought in the development of sectional upward acting doors is the provision of door panels which may be fabricated economically while providing a suitable shape or profile of the upper and lower edges of the panels to minimize the chance of pinching a person's fingers between adjacent panels at the outer or inner side of the door during movement of the panels between door open and closed positions.

Another problem which has not been satisfactorily solved by prior art sectional door designs is the provision of a panel configuration, with or without a pinch resistant edge profile, which also provides for minimizing or eliminating hinge parts which project from the plane of the inner side of the door panel. Accordingly, there has been a need and desire to provide sectional doors wherein the door panels may be stored and shipped to an installation site as substantially flat panels without irregular thickness caused by hinge members or guide member support parts projecting from the plane of the panels.

Still further, there has been a need to provide sectional door assemblies wherein the door panels may be easily connected to each other during assembly of the door at its installation site. In this regard, it has also been deemed desirable to provide for hinge assemblies for interconnecting adjacent door panels wherein the hinge leaves may be easily connected to each other and wherein the hinge leaves may be preassembled to the respective panels, if desired, prior to shipment of the door to the installation site. Furthermore, it has been deemed desirable to provide panel guide member support brackets which permit substantially lateral assembly of the panels between the door guide tracks.

Other desiderata in the art of sectional upward acting doors have been provided by the present invention, as will be appreciated by those skilled in the art upon reading the detailed description which follows in conjunction with the drawing.

SUMMARY OF THE INVENTION

The present invention provides an improved sectional upward acting door which includes door panels having cooperating edge profiles which minimize pinching action therebetween when moving between door open and closed positions.

In accordance with one aspect of the present invention, a sectional upward acting door is provided with door sections or panels which are preferably constructed of rolled or extruded metal or plastic and have cooperating edge profiles wherein the panel edges coact in such a way as to minimize a pinching action therebetween and which edges have a configuration which facilitates interconnecting the door panels by improved hinge assemblies which, preferably, do not project inwardly beyond the inner plane of the door panel. The configuration of the door panels is also advantageous with respect to the configuration of and fabrication of multiple door types which include uninsulated panels as well as insulated panels of varying insulation thickness.

In accordance with another aspect of the present invention, a sectional upward acting door is provided which includes improved hinge assemblies for interconnecting the adjacent door panels, which hinge assemblies are adapted to cooperate with the door panels to be disposed substantially within a channel or trough space formed between adjacent panels when the door is in a closed position to eliminate projection of the hinge assemblies from the inner side or plane of the door panels.

In accordance with yet another aspect of the present invention hinge assemblies, particularly useful for interconnecting panels of a multipanel or sectional type door, are provided wherein opposed leaves of the hinge assemblies may be "snapped" or pushed together to facilitate ease of assembly of respective door panels to each other. In this way, the door hinge parts or leaves may be assembled to the respective panels prior to shipment to the installation site and the door panels may be interconnected onsite by merely "stacking" the door panels one on top of the other, during which process the hinge parts or leaves automatically interengage with each other to form hinge assemblies between adjacent panels.

Still further, the present invention provides an improved sectional or multipanel garage door and the like which includes hinge assemblies which may be easily snapped or pushed together and also includes improved door guide member support brackets which may also be quickly assembled to a door panel by a snap-in or push-in type motion to assemble the guide member support brackets to structural members of a door panel. In this way the door panels may be assembled substantially laterally with respect to the door guide tracks which receive the aforementioned guide members. Accordingly, an improved door assembly method is also provided which avoids a requirement to preassemble the guide member support brackets to the door panels, thus providing for easier packing and shipping. Moreover, the door panels do not require to be assembled by lifting the panels into positions required by prior art door panels with preassembled guide member support brackets and which must be connected to the guide tracks by inserting the door panels into the horizontal overhead run portion of the guide tracks. Accordingly, the door panels being fitted to a door opening may be assembled by stacking the panels vertically or inserting the panels through the horizontal sections of the guide tracks, if desired. A major advantage of the configuration of the improved sectional door is that the door panels no longer require that the hinge components be fastened to the panels after they have been put in place adjacent each other in the door opening or in the overhead horizontal run portion of the guidetracks.

Those skilled in the art will further appreciate the above-mentioned features and advantages of the present invention together with other important aspects thereof upon reading the detailed description which follows in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an improved sectional upward acting door in accordance with the invention;

FIG. 2 is an exploded perspective view of two adjacent door panels, including the bottom panel of the sectional door shown in FIG. 1;

FIG. 3 is a detail perspective view of two adjacent panels of the door shown in FIG. 1 together with one embodiment of a hinge assembly for interconnecting the panels;

FIG. 4 is a detail section view taken normal to the panel hinge pivot axis and showing the configurations of the cooperating edges of the door panels which provide the pinch resistant profile;

FIG. 5 is a section view of a fully insulated door panel in accordance with the invention with a rear skin or backer member removed therefrom;

FIG. 6 is a section view of a partially insulated door panel in accordance with the invention;

FIG. 7 is a section view of another partially insulated door panel in accordance with the invention;

FIG. 8 is a detail section view similar to FIG. 4 showing another embodiment of a door panel in accordance with the invention;

FIG. 9 is an exploded perspective view of one preferred embodiment of a hinge assembly in accordance with the present invention;

FIG. 10 is a perspective view of the hinge assembly shown in FIG. 9 assembled and connected to adjacent door panels;

FIG. 11 is an exploded perspective view of a first alternate embodiment of a hinge assembly in accordance with the invention;

FIG. 12 is a view of the hinge assembly of FIG. 11 in an assembled condition;

FIG. 13 is an exploded perspective view of a second alternate embodiment of a hinge assembly in accordance with the present invention;

FIG. 14 is a perspective view of the hinge assembly of FIG. 13 in an assembled condition;

FIG. 15 is developed plan view of one of the hinge leaves of the hinge assembly shown in FIGS. 13 and 14;

FIG. 16 is a detail section view taken from the line 16—16 of FIG. 14 and showing the upper hinge leaf rotated to an alternate position;

FIG. 17 is a perspective view of two adjacent door panels shown connected by one embodiment of hinge assemblies in accordance with the invention and also showing two opposed guide member support brackets in accordance with the invention;

FIG. 18 is an end elevation of one of the end stiles for supporting the guide member support brackets shown in FIG. 17;

FIG. 19 is a detail side elevation of a part of the end stile shown in FIGS. 17 and 18;

FIG. 20 is a detail view showing the configuration of one of the guide member bracket support tabs for the stile member shown in FIGS. 18 and 19;

FIG. 21 is a rear elevation of a guide member support bracket;

FIG. 22 is a detail section view taken generally along the line 22—22 of FIG. 20;

FIG. 23 is a perspective view of an uninsulated door panel in accordance with the present invention;

FIG. 24 is a detail view of a portion of the panel shown in FIG. 23 on a larger scale;

FIG. 25 is a section view taken generally along the line 25—25 of FIG. 23; and

FIG. 26 is a detail section view taken generally along the line 26—26 of FIG. 25.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the description which follows, like parts are marked throughout the specification and drawing with the same reference numerals, respectively. The drawing figures may not necessarily be to scale and certain features of the invention may be shown in generalized form in the interest of clarity and conciseness.

Referring to FIG. 1, there is illustrated a sectional upward acting door in accordance with the invention and generally designated by the numeral 20. The door 20 comprises a plurality of interconnected, generally planar door panels 22 which are configured to have edge profiles which cooperate with each other between adjacent door panels to provide for minimizing pinching of a person's fingers, for example, when the door panels are moved relative to each other between open and closed positions of the door. The door panels 22 are interconnected by improved hinge assemblies in accordance with the invention, one embodiment of which is illustrated in FIG. 1 and designated by the numeral 23. The hinge assemblies 23 are spaced apart between opposite side edges 22a and 22b of the respective door panels 22, as illustrated in FIG. 1. The sectional door 20 is also supported for movement between the closed position shown, which closes an opening in a wall 26, and an open position by spaced apart guide tracks 28 and 30.

Opposed guide members 32 are mounted on the door 20 at spaced apart positions on panels 22 in a manner to be described in further detail herein and are retained in generally channel shaped grooves 28a and 30a formed in the guide tracks 28 and 30, respectively, in a known manner for supporting the door in its open and closed positions and for guiding the door during movement therebetween. The guide tracks 28 and 30 are configured to include horizontal run portions 28b and 30b for storing the door 20 in its open position and vertical run portions 28c and 30c for supporting the door in its closed position. A suitable counterbalance mechanism 34 is mounted on wall 26 generally above and adjacent to the door 20 and is connected to the door by spaced apart depending cables or similar suitable flexible members 35, also in a known manner. A preferred type of counterbalance mechanism 34 is disclosed in U.S. patent application Ser. No. 09/096,663 filed Jun. 12, 1998 and assigned to the assignee of the present invention. Operator mechanism for moving the door 20 between open and closed positions may be of a conventional type, not shown.

Referring to FIGS. 2 and 3 and FIG. 2, in particular, two adjacent panels 22 are shown in an exploded view wherein the hinge assemblies 23 are positioned spaced apart from each other and are adapted to interconnect the panels. Each of the panels 22 has an upper longitudinal edge 38 and a lower, generally parallel longitudinal edge 40. The panels 22 are preferably reinforced by structural members comprising opposed end stiles 42 and 44 having rearwardly facing flanges 43 and 45, respectively, and lateral flanges 46 and 47, respectively, for closing the side edges 22a and 22b of the panels. The stiles 42 and 44 are adapted to support guide member support brackets, not shown in FIG. 2, for supporting the guide members 32 shown in FIG. 1. The guide

member support brackets are preferably a type to be described in further detail herein. Intermediate reinforcing members or stiles **50**, see FIG. 1, may also be secured to the panels **22** and extending between the edges **38** and **40** of each panel. Intermediate stiles **50** are used, particularly, if the door panels are uninsulated whereby the panels require the additional support which otherwise is provided by insulation material.

Referring further to FIGS. 3 and 4, each panel **22** may be formed of a rolled or extruded metal or plastic sheet including a generally planar outer wall **52** extending between the top edge **38** and bottom edge **40**. The top edge **38** of each panel is formed by a first inwardly sloping generally planar surface **54** which is contiguous with the outer surface **52** and also with a concave curvilinear surface **56**, as shown in FIG. 4 in particular. Upper edge **38** is also formed by a further upwardly and rearwardly inclined surface **58**, FIG. 4, which forms an angle "m" with planar surface **52** in a range of about 19° to 20°. Surface **58** is contiguous with a second upwardly and rearwardly inclined surface **60** which forms an angle "n" with the surface **52** of between about 23° to 25°. Surface **60** is contiguous with a convex curvilinear surface **62** having a substantially constant radius and which is also contiguous with a convex curvilinear surface **64** of significantly smaller radius of curvature with respect to surface **62** at the apex of the edge **38**. Curvilinear surface **64** is further contiguous with a generally vertically extending planar surface **66** which is substantially parallel to surface **52** of panel **22** and is also contiguous with an inclined surface **68**, preferably forming an angle of about 45° with respect to surface **52**. Inclined surface **68** extends between vertical surface **66** and an inner, generally planar and downwardly extending wall part **70** which is parallel to surfaces **52** and **66**.

Inner wall part **70** is intersected by a portion of panel **22** forming a groove **72** which extends generally normal to inner wall part **70** and outer panel wall part or surface **52**. Finally, the upper end of each panel **22**, preferably terminates in a further portion of inner wall part **74** which extends to a downwardly facing edge **74a**. Generally planar inner wall part **74** is offset slightly toward outer wall part or surface **52** from inner wall part **70** or may be substantially coplanar with inner wall part **70**. As further shown in FIG. 4, as well as FIG. 3, a generally planar reinforcing plate **76** extends along and is contiguous with inclined surface **68** for supporting suitable threaded fasteners for securing a lower leaf or plate member of the hinge assembly **23** to the inclined surface **68** of panel **22** in the manner shown in FIGS. 3 and 4.

Referring still further to FIG. 4, in particular, the lower edge **40** of each panel **22** is defined by a circular radius convex tip **78** contiguous with the outer wall part or surface **52** and with a generally planar upwardly inclined surface **80** which extends inwardly from the surface **52** at an angle in the range of about 11° to 12° with respect to the planar surface **52**. Planar surface **80** is contiguous with a second planar surface **82** which extends inwardly toward the inner wall of panel **22** and at an angle of about 24° to 25° with respect to surface **52**. A third generally planar surface **84** extends at a further steeper angle with respect to surface **52** to an elongated groove or recess **86** which extends the length of the edge **40** and is adapted to receive a resilient elastomeric seal member **88** forcibly retained therein or by means such as a suitable adhesive. As shown in FIG. 2, a flexible, elongated bottom edge seal strip **91** may be retained in groove **86** of the lowermost panel **22** to seal the bottom edge of door **20** against a floor surface, if desired

A still further inclined surface **90** extends from groove **86** at an angle of about 60° with respect to surface **52** to an inner lower panel wall part **92** which extends upwardly toward wall part **70** and is coplanar therewith. Inner surface or wall part **92** is intersected by a transverse groove **94** extending normal thereto. Finally, a generally planar wall part **96** extends parallel to wall part **92** and may be slightly offset therefrom toward surface **52**. Wall part **96** terminates at an upwardly facing edge **96a**, viewing FIG. 4. A generally planar reinforcing plate **98** extends along the inside surface of panel wall part or surface **90** and is suitably adhered thereto to form a reinforcement for threaded fasteners adapted to secure the upper leaf or plate of hinge assembly **23** to the panel at the surface **90**. The parts aforescribed for edges **38** and **40** extend between side edges **22a** and **22b** of each panel **22**.

Several benefits are achieved by the configurations of the cooperating top edges **38** and bottom edges **40** of the panels **22**. As will be appreciated from viewing FIGS. 3 and 4, the configurations of the panel edges **38** and **40** provide for a cavity, generally designated by numeral **100** and defined generally by the surfaces or wall parts **66**, **68** and **90** when the panels are mounted adjacent to each other and extend substantially coplanar with each other to receive the hinge assemblies **23** substantially within the confines of the panels. In other words, hinge assemblies **23** do not extend rearwardly of the surfaces or wall parts **70** and **92** to thereby provide a generally flush, unobstructed inner surface of the door **20**. Pivot axis **102**, FIG. 4, of each hinge assembly **23** is disposed between the inner surface of the door **20** defined by the panel surfaces or wall parts **70** and **92** and the outer surface or wall part **52**. This location of the hinge pivot axis also minimizes the clearance requirements for the door **20** when the panels **22** articulate with respect to each other.

The geometry of the portion of the edge **38** defined by the surfaces **58**, **60** and **62** is generally convex but not curved throughout its extent, primarily so as to facilitate ease of fabrication. Still further, the configuration of the edge **40** between the tip **78** and the groove **86** is somewhat concave but also not curvilinear, and therefore has no radius of curvature, also to facilitate fabrication. Thus the panel edge configurations **38** and **40** provide for ease of manufacture of the panels **22**, provide adequate clearance between the edges **38** and **40** during articulation of the panels but also minimizes the gap between the edges **38** and **40** to prevent a person's fingers being inserted between the panels from either side of the door **20**. The seal member **88** advantageously engages the edge **38** to provide a substantially weathertight seal when the door **20** is in a closed position and cushions the final stage of movement between door panels **22** when moving to the position shown in FIGS. 3 and 4.

As also shown in FIGS. 3 and 4, a variable thickness gap **106** is formed between the edges **38** and **40** in the closed position of the door **20** to provide adequate clearance between the edges **38** and **40** as the panels **22** articulate with respect to each other. However, the gap **106** is of reduced width, particularly at the point where the convex circular tip **78** is disposed adjacent the surfaces **54**, **56**, **58** to minimize the insertion of any object, including a person's fingers between the panels, and to assist in providing a weathertight joint between panels in the closed position of the door **20**. Moreover, the concave, segmented configuration of the edge **40** provided by the surfaces **80**, **82** and **84** maintains a sufficiently narrow gap distance between the tip **64** and the seal member **88** as well as the bottom edge **40** to prevent insertion of an object, including a person's fingers, between

the door panels **22** from the inner side of the panels when the panels are articulating or pivoting with respect to each other. Moreover, the portion of the overall width of a panel **22** which is required for the portions of the edges **38** and **40** which provide the pinch resistant edge profile is less than about 50% of the overall width or thickness of the panel **22**. This arrangement also simplifies manufacturing or fabrication of the panel and strengthens the panel edges against unwanted plastic deflection.

Referring again to FIG. **3**, each hinge assembly **23** includes opposed hinge plates or leaves **110** and **112**, both of which are generally channel shaped. Hinge plate **110** includes a base web **110a** and spaced apart flanges **110b** extending normal to web **110a**. Hinge plate **112** includes a base web **112a** and spaced apart flanges **112b** extending normal to the web **112a**. A cylindrical tubular hinge pin **114** extends through suitable bores in the flanges **10b** and **112b** and may be force fitted in the bores in the flanges **10b** to retain the hinge plates **110** and **112** connected to each other. The hinge plates **110** and **112** are suitably connected to adjacent panels **22** by conventional hexhead self-tapping threaded fasteners **116** extending through suitable bores in the webs **110a** and **112a** and through the wall parts or surfaces **68** and **90** as well as the reinforcing plates **76** and **98** to provide a hinge connection between panels **22**.

Referring now to FIG. **5**, the panels **22** may be modified to be further reinforced and to have additional insulative properties by filling a cavity **25** between the top and bottom edges **38** and **40** with a suitable insulative foam material **25a**. The cavity **25** is preferably closed by a generally planar sheet backer member **120** formed of steel, plastic or a metal foil Kraft paper composite, for example. Backer member **120** includes opposed generally parallel short flanges **122** and **124** insertable in the grooves **72** and **94**. The backer member **120** is preferably secured to the insulative foam **25a** and wall parts or surfaces **74** and **96** by a suitable adhesive.

FIG. **6** illustrates a further modified panel **22** wherein a backer panel or member **126** similar to the backer **120** is provided but is of a configuration which includes a planar wall part **128** which is recessed inwardly toward the surface **52** to reduce the thickness of an insulation foam layer **25b** from that of the panel embodiment shown in FIG. **5**. FIG. **7** illustrates a further embodiment of panel **22** wherein a backer member **130** includes a planar wall part **132** recessed even further toward the surface **52** to further reduce the thickness of an insulation foam layer **25c**. The backer members **126** and **130** are otherwise constructed like the backer member **120** including opposed flanges insertable in the grooves **72** and **94** and being adapted to be adhered to the inner wall parts or surfaces **74** and **96**.

Referring now to FIG. **8**, an alternate embodiment of a door panel in accordance with the invention is illustrated by showing the upper and lower edges of adjacent panels. The panels of the embodiment of FIG. **8** are generally designated by the numerals **136** and have outer, generally planar, wall parts or surfaces **52a**. Upper and lower panel edges **38a** and **40a** are formed with cooperative edge surfaces substantially like the panels **22**, that is, lower edge **40a** includes a tip **78a** and contiguous surfaces **80a**, **82a** and **84a** having generally the same geometry with respect to the surface **52a** as the corresponding surfaces of the panel **22**. However, the panel member portion making up the surfaces **52a**, **78a**, **80a**, **82a** and **84a** terminates in a flange portion **85** extending generally parallel to surface **52a**. Each panel **136** is formed of a second panel part delimited by a flange **87** spaced from the flange **85** and contiguous with an inclined surface **90a** which extends to surfaces **92a**, **96c**, which are intersected by a

groove **94a**, as shown in FIG. **8**. The panel parts **136a** and **136b** are secured together at the flanges **85** and **87** by an elongated resilient elastomeric gasket or seal member **88a** disposed between flanges **85** and **87**, and secured thereto by a suitable adhesive.

Referring further to FIG. **8**, in like manner the edge **38a** extends inwardly from outer surface or panel wall part **52a** and is formed by a concave curvilinear surface **56a** and contiguous surfaces **58a**, **60a** and **62a** having geometry similar to the surfaces **58**, **60** and **62** of the panel **22**. However, surface **62a** is contiguous with a convex curved apex or tip **64a** which is also contiguous with a planar distal flange **89** extending generally parallel to surface **52a**. The upper edge of a third panel part **136c** is formed by an in-turned flange **91** forming the terminal part of rear panel surface **66a** which is contiguous with an inclined surface **68a**. Surface **68a** terminates in a generally planar inner wall part or surface **70a** similar to surface **70**. A groove **72a** and wall part **74c** further define panel part **136c**. An elongated elastomeric gasket or seal member **88b** is sandwiched between and suitably secured to the flanges **89** and **91** to join the panel parts **136a** and **136c** together at the upper edge **38a**. As shown in FIG. **8**, when adjacent panels **136** are interconnected by hinge assemblies **23**, for example, and pivoted to the door closed position wherein the panels are substantially coplanar, the gasket or seal members **88a** and **88b** engage each other to form a substantially weathertight seal. The panels **136** may be hinge together by a hinge assembly **23** or by other embodiments of improved hinge assemblies in accordance with the invention to be described in further detail herein. One advantage of the panel **136** is the provision of a thermal break between the outer panel part **136a** and the inner panel parts **136b** and **136c**, as provided by the combination gasket and seal members **88a** and **88b**.

Referring now to FIGS. **9** and **10**, a preferred embodiment of a hinge assembly useful with the sectional door **20**, as well as certain other sectional doors, is illustrated and generally designated by the numeral **140**. The hinge assembly **140** includes upper and lower hinge leaves or plates **142** and **144** adapted to be secured, respectively, to the panel wall parts or surfaces **90** and **68**, as illustrated in FIG. **10**. The upper hinge plate **142** is a substantially channel shaped member having a base web **142a** and opposed generally parallel flanges **142b** and **142c**, FIG. **9**, which extend normal to web **142a** and are provided with suitable bores for receiving an elongated cylindrical tubular hinge pin **146** extending between and supported by the flanges **142b** and **142c**. The hinge pin **146** includes opposed distal ends **146a** and **146b** which project outwardly from the flanges **142b** and **142c**, as shown in FIG. **9**. The pin distal ends **146a** and **146b** may be flared slightly radially outwardly and disposed adjacent suitable reinforcing collars **142e**, one shown in FIG. **9**, disposed between the pin distal ends and the flanges **142b** and **142c**, respectively.

The hinge plate **144** is also a generally channel shaped member having a base web **144a** and upturned parallel flanges **144b** and **144c** spaced apart and extending generally normal to the web **144a**. Flange **144b** is provided with a pin receiving bore **148** and a generally outwardly flared funnel-like wall portion **150** providing a sloped recess for guiding the distal end **146a** of pin **146** into the bore **148**. An elastically deflectable pin retainer tab **152** defines part of the bore wall of the bore **148** and also forms part of the guide or wall portion **150** of flange **144b**. Flange **144c** is provided with a bore **148a** coaxial with bore **148**, and an outwardly flared funnel wall portion **150a** of flange **144c** including an elastically deflectable pin retainer tab **152a**. Accordingly, flange **144c** comprises a mirror image of flange **144b**.

Hinge plates **142** and **144** may be secured together to provide the hinge assembly **140**, as shown in FIG. **10**, by preferably first securing the hinge plates **142** and **144** to the respective wall parts or surfaces **90** and **68** with fasteners **116**, for example. Then, when one panel **22** is desired to be stacked on top of another panel **22**, generally in the position shown in FIG. **10**, the panels are moved relative to each other, while being maintained substantially coplanar, to bring edges **38** and **40** adjacent each other while the opposed distal ends **146a** and **146b** of pin **146** are guided by the flared wall portions **150** and **150a** until the tabs **152** and **152a** are deflected sufficiently to allow the pin distal ends to snap into the bores **148** and **148a**. The flared portions **150** and **150a** are spaced apart sufficiently such that the pin **146** may be inserted therebetween and gradually forcibly engage the flared portions and elastically deflecting flanges **144b**, **144c** and the tabs **152** and **152a**. When the pin **146** is secured to the hinge plate **144**, as shown in FIG. **10**, the tabs **152** and **152a** engage the pin distal ends **146a** and **146b**, respectively, to retain the pin **146** in the bores **148** and **148a** and secured to the hinge plate **144** to form the hinge assembly **140**.

Accordingly, in this way two door panels **22** may be assembled to each other by aligning one panel with the other and inserting the hinge pin distal ends into the bores of the hinge plates **144** in the manner just described to essentially snap the hinge plates **142** and **144** of the hinge assemblies **140** together to form the hinge assemblies and to secure the door panels **22** to each other for pivotal movement about the longitudinal central axes **151** of the hinge pins **146**. If it is desired to disassemble the hinge assembly **140**, the elastically deflectable tabs **152** and **152a** may be deflected outwardly away from each other by a suitable tool, not shown, sufficiently to clear the distal ends **146a** and **146b** of pin **146** whereby the hinge plate **142** may be lifted out of engagement of the pin **146** with the flanges **144b** and **144c** by reversing the direction of movement of the hinge pin with respect to the hinge plate **144**, as described above. Hinge pin **146** may comprise integral or separately fabricated trunnions disposed on the flanges **142b** and **142c** and forming the pin distal ends **146a** and **146b**, respectively, if desired, instead of use of the continuous tubular pin, as shown.

Referring now to FIGS. **11** and **12**, a first alternate embodiment of a snap together hinge assembly in accordance with the invention is illustrated and generally designated by the numeral **160**. The hinge assembly **160** advantageously utilizes the hinge plate **142** and pin **146** but includes a substantially modified pin receiving hinge plate or leaf **162**. Hinge plate **162** includes a mounting flange **164** comprising a generally flat rectangular plate-like part which is integrally joined with a semicylindrical bearing part **166** having a pin receiving bearing bore **168** formed therein, FIG. **11**, and extending between opposite sides **166a** and **166b** of bearing part **166**. Bearing part **166** is dimensioned such that hinge plate **162** may be disposed between flanges **142b** and **142c**, as shown in FIG. **12**. Bearing part **166**, FIG. **11**, includes opposed spaced part upstanding wall parts **169** and **170** which are integrally formed with in-turned opposed pin retainer fingers **171** and **172** which are inclined toward each other to form a somewhat V-shaped slot **173** which opens toward bearing bore **168**. The opposed fingers **171** and **172** of the wall parts **169** and **170** are elastically deflectable toward their integral supporting wall parts **169** and **170** to provide sufficient clearance to allow a hinge pin **146** to be received in pin bearing bore **168**. The elastically deflectable parts or fingers **171**, **172** are dimensioned to further define the bore **168** so that once the pin **146** has passed through the slot **173** and deflected the fingers **171** and **172** sufficiently to

be disposed in the bore **168**, the fingers **171** and **172** snap back into the positions shown in FIG. **11** to retain the pin **146** in bearing bore **168** and firmly attached to hinge plate **162**.

Accordingly, the hinge assembly **160** also forms a snap together hinge, as illustrated in FIG. **12**, whereby movement of the hinge plate **160** toward the hinge plate **162** somewhat forcibly will enable the hinge pin **146** to momentarily elastically deflect the fingers **171** and **172** sufficiently to allow the pin to move into the bore **168** whereby the tabs then return to their original undeflected positions to retain the pin in the bore. As with the hinge assembly **140** shown in FIGS. **9** and **10**, a suitable tool may be provided to elastically deflect the fingers **171** and **172** to enable the hinge plates **142** and **162** to be separated if it is desired to disassemble the hinge assembly **160**.

Referring now to FIGS. **13**, **14** and **16**, a second alternate embodiment of a snap together hinge assembly in accordance with the present invention is illustrated and generally designated by the numeral **180**. The hinge assembly **180** advantageously utilizes the lower hinge plate **162** but includes a one piece hinge plate or leaf **182** having an integral hinge pin **184** formed thereon. Hinge plate **182** includes a generally planar and rectangular web part **186** formed with suitable bores **183** therein for receiving fasteners **116** to secure the hinge plate **182** to the wall part or surface **90**, for example, of a panel **22**. Web part **186** is integrally joined with a wall part **187** which, in turn, is integrally formed with the pin **184**. Opposed hinge locating and restraining tabs **187a** and **187b** project normal the plane of the wall part **187** and are engageable with opposite end faces **166a** and **166b** of the hinge plate **162**, FIG. **14**, to restrain axial displacement of the hinge plates relative to each other to prevent lateral disassembly of the hinge members of hinge assembly **180** when the hinge plates or leaves **162** and **182** are in the position of these members indicated in FIG. **14** or when the hinge plates are rotated relative to each other during normal movement of the door panels between door open and closed positions of the door.

However, as shown in FIG. **16**, the hinge plates **162** and **182** may be rotated relative to each other so that the restraining tabs **187a** and **187b** as well as the wall part **187** may be disposed between the fingers **171** and **172**, as shown. In this position of the hinge plates **162** and **182** relative to each other, the plates may be separated by sliding the pin **184** out of the bore **168** along the bore axis. The hinge plates **162** and **182** would, normally, be disassembled from the door panels **22** before separation from each other in the manner just described. Tabs **187a** and **187b** may be integrally formed as part of the entire integral hinge plate **182** by suitable stamping operations, for example

Referring briefly to FIG. **15**, which is a developed plan view of the hinge plate or leaf **182**, the hinge plate **182** may be formed by removing metal to form the irregular shaped opening **189** and the inverted V-shaped recess **191** which corresponds in shape, substantially, to the triangular shaped part **184a** of pin **184**. Accordingly, when the larger generally rectangular part **184b** and part **184a** are rolled in opposite directions, the cylindrical hinge pin **184** may be formed and a somewhat chevron-shaped groove or slot **184c**, see FIG. **13**, is formed which is advantageous and eliminates, substantially, the chance of snagging the hinge pin **184** by the distal ends of the fingers **171** or **172** when the hinge assembly **180** is working.

As illustrated in FIG. **14**, the hinge assembly **180** may be snapped together at any time, or once the respective hinge plates **162** and **182** have been secured to the respective top

and bottom edges of adjacent door panels in the same manner as the embodiments of FIGS. 9 through 12. The fingers 171, 172 are deflected by forcing the pin 184 into the bearing bore 168 while allowing the fingers 171 and 172 to be elastically returned to their normal working positions shown in FIGS. 13, 14 and 16, thanks to the elastic memory the fingers 171 and 172 retain as being formed of part of the spaced apart wall portions 169 and 170. Thanks also to the provision of the spaced apart tabs 187a and 187b, the hinge plate 182 may not be laterally displaced out of engagement with the hinge plate 162 during normal operation of the hinge assembly 180.

Those skilled in the art will appreciate that the hinge assemblies 140 and 160 are prevented from lateral disengagement since the flanges 142b and 142c of the hinge plate 142 are operable to engage the flanges of plate 144 or, respectively, the opposite side faces 166a and 166b of hinge plate 162. Of course, with respect to all of the embodiments disclosed in FIGS. 9 through 14, these hinge assemblies may be secured to the door panels in the manner that the hinge assembly 23 is secured, that is, by aligning the panels initially and securing the hinge plates to the respective edges of adjacent panels with fasteners 116, for example, with the respective hinge plates already secured to each other to form the hinge assemblies. However, a major advantage of the hinge assemblies 140, 160 and 180 is the provision of the snap together feature which allows the door panels to be prefabricated with the hinge plates of the respective hinge assemblies secured to the respective bottom and top edges of adjacent panels, if desired.

Referring now primarily to FIG. 17, a portion of the sectional door 20 is illustrated including two adjacent panels 22 which are connected to each other by hinge assemblies 140, as illustrated. The door 20 is also advantageously provided with spaced apart guide member support brackets 190 secured to the respective end stiles 42 and 44 in a unique manner, as will be described hereinbelow, and also secured to the inclined surface 68 of the panel upper edge, as illustrated, by fasteners 116, respectively. The brackets 190 are each adapted to support a guide member, such as a roller assembly 32, each of which includes a roller 32a supported for rotation on a shaft 32b. Each of the brackets 190 includes a substantially planar base or web part 192 and opposed parallel flanges 194 and 196 which extend normal to the web part 192 and support a substantially tubular bearing member 198 extending therebetween. Tubular bearing member 198 is adapted to support the shaft 32b of a roller assembly 32, as shown in FIG. 17. The base or web 192 of each bracket 190 also includes an inclined portion 192a adapted to receive the fasteners 116 for securing the brackets, respectively, to the inclined surface 68 of the upper edge of a panel 22, as shown.

As further shown in FIG. 17, as well as FIGS. 18 through 20, each of the end stiles 42 and 44 is adapted to receive the base or web part 192 of a bracket 190, respectively, secured to the stile by inserting a lower portion of the web 192 into receiving slots formed by laterally displaced and integrally formed retaining tabs 43a, 43b and 45a, 45b formed on the respective flanges 43 and 45. The end stiles 42 and 44 are substantially mirror images of each other and a further description of the end stile 42 is believed to be sufficient to enable one to practice the invention, including provision of the end stile 44.

Referring primarily to FIGS. 18 through 20, the end stile 42, as shown in FIG. 18, has across section which includes the flanges 43 and 46 and a short flange 46f extending generally parallel to the flange 43. The tabs 43a and 43b are

displaced slightly outwardly from the plane of the flange 43 on the side of the flange 43 opposite the side which faces the flange 46f. The tabs 43a and 43b are formed by cutting the flange 43 along lines 43a', 43a'' and 43a''', as well as along lines 43b', 43b'' and 43b''', as also shown in FIG. 20. Accordingly, the tab 43b is unsupported along the edges which correspond to the lines 43b', 43b'' and 43b''' to allow insertion of a corner of the lower portion of the web 192 of a bracket 190 to be supported by the tab, as also shown in FIG. 20. Tabs 43a and 43b also prevent lateral displacement of the bracket 190 out of the slots formed by the tabs. Accordingly, a suitable die forming or other metal displacing operation may be performed to form the tabs 43a and 43b on the flange 43 as well as the tabs 45a and 45b on the flange 45 of end stile 44.

Referring now to FIG. 21, an elevation view of the bracket 190 is shown wherein it is indicated that two integral bosses 192b and 192c are formed on the web 192 suitably spaced from lower edge 192d. Bosses 192b and 192c are preferably formed by displacing and partially shearing the material of the web 192 to form co-linear surfaces 192b' and 192c' respectively, see FIGS. 21 and 22. The bosses 192b and 192c project from the surface 192s of the web 192 in the direction of inclination of the web part 192a and are configured to allow snapping the bosses into the slots in the flange 43 which are formed by displacing the material of the flange 43 to form the tabs 43a and 43b. FIG. 22 illustrates the manner in which the bracket 190 may be disposed in engagement with the flange 43 of the stile 42 wherein, for example, the tab 43b is shown displaced from the plane of the flange 43 to form the elongated slot and opening 43s adapted to receive the web 192 of a bracket 190 and whereby the boss 192b may reside in the opening 43s with its edge 192b' engaged with a flange surface 43s'.

Accordingly, by inserting the web 192 of a bracket 190 between the tabs 43a and 43b and the flange 43, for example, the bracket may be forcibly engaged with and retained on the stile 42 by placement of the bosses 192b and 192c in the openings formed by the respective tabs 43a and 43b as shown and described for the tab 43b, for example. In this way, a bracket 190 may be moved into position adjacent the flange 43 or 45 of an end stile and then moved downwardly by sliding action until the bracket web 192 slides between the tabs of the associated flange and until the bosses are forcibly engaged with the flange in the manner described above to essentially lock the bracket 190 to a panel 22. After inserting the web 192 of a bracket 190 into engagement with the associated retaining tabs on a stile 42 or 44 and in the positions shown in FIG. 17, the fasteners 116 may be applied to retain the bracket firmly attached to a panel 22. When it is desired to remove a bracket 190 from a panel 22, the fasteners 116 are removed and the bracket is then deflected away from the stile flange 43, for example, sufficiently to elastically deflect the tabs 43a and 43b, to allow the bosses to clear the edges 43s' to remove the bracket from the door panel.

Accordingly, an improved assembly method for a sectional door panel may be carried out utilizing one of the hinge assemblies such as a hinge assembly 140, 160 or 180 for interconnecting two adjacent panels and by also utilizing panels configured as illustrated in FIG. 17, including the guide member retaining and support brackets 190. For example, viewing FIGS. 1 and 17, the lowermost panel 22 of the door 20 may be placed in position between the guide tracks 28 and 30 and connected to the guide tracks by guide members 32 which are connected to panel bottom edge guide member support brackets substantially like those

disclosed in my copending U.S. patent application entitled: Bottom Bracket For Upward Acting Door, Ser. No. 09/552, 492, filed Apr. 19, 2000, and assigned to the assignee of the present invention, which application is hereby incorporated herein by reference. The upper edge **38** of lowermost panel **22** may then be suitably secured in place between the guide tracks **28** and **30** by placing respective guide members **32**, in assembly with each of two opposed support brackets **190**, respectively, in the guide tracks **28** and **30** and then sliding the respective brackets along and adjacent to the tracks into engagement with the end stiles **42** and **44** in the manner described above in conjunction with FIGS. **18** through **22**. The lowermost panel **22** is now secured between the tracks **28** and **30**. The lowermost panel **22** will also, at this time, be provided with spaced apart hinge members **144**, for example, secured to the upper edge **38** in the manner previously described while the next panel **22** to be connected to the lowermost panel **22** is assembled to hinge members **142** at corresponding spacings on the lower edge **40** of the next panel **22**.

The next panel **22** may then be placed in position by moving the next panel generally laterally into a position between the guide tracks **28** and **30**, and just above the lowermost panel **22** and then moving the next panel downward between the guide tracks to snap the hinge members **142** into engagement with the respective hinge members **144** to form the hinge assemblies **140**. While holding the next panel **22** in position between the guide tracks **28** and **30**, and substantially coplanar with the lowermost panel **22**, the brackets **190**, in assembly with guide members **32** may be positioned above the upper edge **38** of the next panel **22** while placing the guide member rollers **32a** in the track grooves **28a** and **30a** and then moving the brackets downward to be snapped into the slots formed by the tabs on the respective end stiles **42** and **44**. Next panel **22** is now secured between the tracks **28** and **30** and is ready to receive a third panel **22** of the door **20** which is assembled to the door in the same manner just described.

Prior to assembly of a third panel to the door **20**, brackets **190** may also be firmly secured to the upper edge **38** of the next or second panel by inserting the fasteners **116** in tight engagement with the web part **192a** to secure each bracket **190** to the inclined surface **68** of a panel **22**, for example. The above described process is repeated for the third and fourth panels as will be appreciated by those skilled in the art. Accordingly, assembly of the door **20** is easily accomplished with the improved hinge assemblies and guide member support brackets of the present invention as will be appreciated from the foregoing description read in conjunction with the drawings. In this way the door **20** may be more easily assembled and does not require lifting the door panels **22** overhead for placement between the horizontal run portions **28b** and **30b** of the door guide tracks **28** and **30**.

Those skilled in the art will also recognize that the hinge assemblies **160** or **180** may be easily substituted for the hinge assemblies **140** without modifying the assembly process just described. Moreover, disassembly of the door **20** may be carried out by substantially reversing the procedure just described and which also offers several advantages as will be appreciated by those skilled in the art.

Referring now to FIGS. **23** through **25**, a modified door panel **222** is illustrated and is characterized, generally, as a so-called pan type panel. Door panel **222** is used in applications where no insulating material is provided between the top and bottom edges of the panel such as is provided in the panels shown in FIGS. **5**, **6** and **7** herein. Panel **222** includes a front, generally planar outer wall part or surface **224**

extending between a top edge **226** and a bottom edge **228**. The configurations of the top edges **226** and **228** are preferably substantially like the edges **38** and **40** of the panels **22**. However, in one preferred embodiment of a pan type panel **222**, the top edge terminates at a sloping or inclined surface **230** which may be folded back on itself at **232**, FIG. **25**, to reinforce a hem or distal edge **233**, as illustrated. As further shown in FIG. **25**, the bottom edge **228** terminates at an inclined inwardly extending surface **234** which is folded back on itself at **236** to define an inner distal edge **237** or hem substantially coplanar with the distal edge **233** in a plane generally parallel to surface **224**. Moreover, in the configuration of the panel **222**, the groove or recess **86** is replaced by an inclined surface **84a** which is contiguous with planar surface **84** which, as with the panels **22**, is contiguous with surface **82**. As also shown in FIG. **25**, the top edge **226** is configured to include surfaces **54**, **58**, **60**, **62** and **64**.

As shown in FIG. **23**, the panel **222** is provided with reinforcing end stiles **242** and **244** which extend between the top and bottom edges **226** and **228** in generally the same manner that the end stiles **42** and **44** extend between the top and bottom edges of the panels **22**. However, the end stiles **242** and **244** are provided with respective flanges **243** and **245** which have end portions which overlap and are disposed adjacent to the surfaces **230** and **234**. As shown by way of example in FIG. **24**, flange **245** of end stile **244** includes a partially folded portion **245a** which extends over and is contiguous with the surface **230**. Accordingly, the hinge part **162** is suitably secured to the panel **222**, as shown in FIG. **24** by fasteners **116** which are adapted to extend through the flange portion **245a** as well as the surface **230**. The opposite end of flange **245** includes a partially folded portion **245b**, FIG. **23**, which overlies and is adjacent to the surface **234** and is adapted to receive the hinge part **182** suitably secured thereto and to the surface **234** by fasteners **116**. As shown in FIG. **23**, the end stile **242** is provided with similar flange portions **243a** and **243b** which overlap and are adjacent to the surfaces **230** and **234**, respectively, and provide additional support for securing the hinge parts **162** and **182**, for example, to the panel **222**, as shown. The stiles **242** and **244** also include bracket receiving bosses **243c**, **243d**, **245c** and **245d**, respectively, corresponding to the bracket receiving bosses **43a**, **43b**, **45a** and **45b** of the stiles **42** and **44**.

Referring further to FIG. **23**, as well as FIGS. **25** and **26**, one or more intermediate stiles **250**, one shown, are adapted to be secured to the panel **222** to reinforce same and extending between the edges **226** and **228**, as shown. Intermediate stile **250** is a somewhat channel shaped member with reentrant distal edges. For example, as shown in FIG. **26**, intermediate stile **250** includes a web **252**, opposed flanges **254** and **256** and reentrant flange edges **254a** and **256a** which are contiguous with the inner face **224a** of outer skin or surface **224** of the panel **222** and may be secured thereto by a suitable adhesive or other fastening means known in the art.

As shown in FIG. **25**, the web **252** includes opposed end parts **252a** and **252b** which are folded to overlap and be disposed adjacent to the inclined surfaces **230** and **234**, respectively, to provide reinforcement for supporting the hinge parts **162** and **182**, as shown. Accordingly, fasteners **116**, which are preferably a self tapping threaded type, are secured to the panel **222** at reinforced areas of a panel provided by the surfaces **230** and **234** and by the stile web parts **252a** and **252b**, respectively. As shown in FIGS. **23** and **25**, at least the flange **256** is relieved at recesses **257a** and **257b** to provide access for securing the stile **250** to the panel **222**.

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The construction, assembly, disassembly and use of the door **20** including the door panels **22** or **222** together with the hinge assemblies **23**, **140**, **160**, **180** and the brackets **190** is believed to be within the purview of one of ordinary skill in the art based on the foregoing description. Materials used for fabricating the parts of the door panels and hinge assemblies of the invention may be conventional materials used for such elements. The hinge plates **162** and **162a** may be advantageously molded of a suitable polymer material, such as polycarbonate or other high impact resistant plastic. However the hinge plates **162** and **162a** may also be fabricated of materials such as glass filled polymers. Although preferred embodiments of a sectional door, door panels, hinge assemblies and other components particularly useful therewith have been described in detail hereinabove those skilled in the art will recognize that various substitutions and modifications may be made to the invention without departing from the scope and spirit of the appended claims.

What is claimed is:

1. A sectional upward acting door including interconnected door panels, said panels comprising generally planar rectangular members each having a generally planar outer wall part and generally planar inner wall parts spaced from said outer wall part, an elongated upper edge of said panel including an upwardly projecting convex surface extending at an angle with respect to said outer wall part and including a curvilinear portion adjacent to and contiguous with a generally planar wall portion, and an inclined wall part extending from said generally planar wall portion, an elongated lower edge of said panel including a tip portion contiguous with said outer wall part, a concave part of said lower edge and a further inclined wall part extending from said concave part, said upper and lower edges being cooperable with each other between adjacent interconnected panels to form a pinch resistant joint when said adjacent panels are pivoted relative to each other, and

plural hinge assemblies spaced apart along and interconnecting adjacent ones of said panels, said hinge assemblies including opposed hinge plates which are operable to engage upon moving adjacent panels toward each other to thereby pivotably connect said adjacent panels, said hinge plates being connected by fasteners to said inclined wall part of one panel adjacent its upper edge and said inclined wall part adjacent said lower edge of an adjacent panel, respectively, whereby said hinge assemblies are disposed substantially entirely between said outer wall part and said inner wall parts of said panels, respectively, and form a pivot connection between adjacent panels.

2. The door set forth in claim **1** including: an elongated groove formed in said lower edge of each of said panels and adapted to receive an elongated resilient seal strip therein, said seal strip being engageable with said upper edge of an adjacent panel to form a seal between adjacent panels when said door is in a closed position.

3. The door set forth in claim **1** wherein: said inner wall parts are integrally joined with said inclined wall parts of said upper and lower edges, respectively, said inner wall parts extending toward each other but leaving a substantial gap therebetween; and

each of said panels includes a reinforcing backer adapted to be secured to said panel and extending between said inner wall parts to form a closed cavity within said panel between said outer wall part and said inner wall parts.

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4. The door set forth in claim **3** wherein: said inner wall parts are formed with respective grooves extending generally toward said outer wall part and adapted to receive opposed spaced apart flanges of said backer, respectively, for supporting said backer on said panel.

5. The door set forth in claim **3** wherein: each of said panels are filled with an insulating material between said outer wall part and said inner wall parts and between said outer wall part and said backer.

6. The door set forth in claim **1** wherein: said upper and lower edges of adjacent panels cooperate with each other to form a variable width gap therebetween extending along said concave part of said lower edge and said convex surface of said upper edge, said gap not increasing as said panels rotate with respect to each other to a point which would permit insertion of a person's finger between said upper and lower edges of adjacent panels.

7. The door set forth in claim **6** wherein: said variable width gap is provided by plural planar segments of said lower edge extending at angles with respect to each other and said outer wall part of said panel, and by said upper edge of an adjacent panel formed by plural contiguous segments which are inclined to each other and to said outer wall part of said panel and by a curvilinear segment adjacent one of said contiguous segments and an apex of said upper edge.

8. The door set forth in claim **1** wherein: said panels are each formed by a first panel part defining said concave part of said lower edge and said convex surface of said upper edge, a second panel part joined to said first panel part and defining one of said inclined wall parts and an inner wall part, and a third panel part defining the other of said inclined wall parts and another inner wall part, said panel parts being joined together at cooperating flanges, and elongated elastomeric gasket members interposed said flanges of said panel parts.

9. The door set forth in claim **8** wherein: said gasket members on respective panels are engageable with each other between adjacent panels to form a seal between said adjacent panels in a closed position of said door.

10. The door set forth in claim **1** wherein: said hinge assemblies each include a hinge pin on one of said hinge plates, at least one bearing bore on the other of said hinge plates for receiving said hinge pin and an elastically deflectable retainer on said other hinge plate for retaining said hinge pin in said bearing bore in response to insertion of said hinge pin into said bearing bore.

11. The door set forth in claim **10** wherein: said other hinge plate includes a web part, spaced apart flanges secured to said web part and extending generally parallel to each other, a bearing bore formed in each of said flanges and guide surfaces formed on each of said flanges for guiding opposed distal ends of said hinge pin into said bearing bores, respectively.

12. The door set forth in claim **11** wherein: said retainer comprises an elastically deflectable tab formed on each of said flanges for retaining opposite ends of said hinge pin in said bearing bores, respectively.

13. The door set forth in claim **10** wherein: said retainer includes opposed elastically deflectable fingers defining a gap therebetween for receiving said

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hinge pin for deflecting said fingers to allow forcible insertion of said hinge pin into said bearing bore, said fingers being elastically restorable to a position to retain said hinge pin in said bearing bore.

14. The door set forth in claim 13 wherein:

said one hinge plate includes opposed parts engageable with said other hinge plate to prevent longitudinal displacement of said hinge plates relative to each other sufficient to disengage said hinge plates from each other in predetermined positions of said hinge plates with respect to each other.

15. The door set forth in claim 13 wherein:

said hinge pin is integrally formed on said one hinge plate.

16. The door set forth in claim 15 wherein:

said hinge pin is formed by opposed pin portions which are rolled in opposite directions to form a substantially cylindrical hinge pin integral with said one hinge plate.

17. The door set forth in claim 1 including:

opposed structural members on at least selected ones of said panels, said structural members including guide member support bracket retaining parts formed thereon, and opposed guide member support brackets operable to be slidably engaged with said structural members and retained thereon for supporting opposed guide members for said panels, respectively.

18. The door set forth in claim 17 wherein:

said retaining parts are formed on said structural members by displacing material from a surface of said structural members, respectively, to form said retaining parts, respectively.

19. The door set forth in claim 18 wherein:

said guide member support brackets each include a web portion and spaced apart bosses formed thereon for engagement with said structural members at locations adjacent said retaining parts, respectively, to provide for assembly of said guide member support brackets to said panels, respectively.

20. A sectional upward acting door comprising interconnected door panels, each of said panels comprising generally planar rectangular members, each having a generally planar outer wall part and generally planar inner wall parts spaced from said outer wall part, an elongated upper edge of said panel including an upwardly projecting convex surface extending inwardly with respect to said outer wall part toward said inner wall part and including a first planar segment inclined with respect to said outer wall part, a further surface inclined with respect to said first planar segment and with respect to said outer wall part, a second planar segment contiguous with and inclined with respect to said further surface and said outer wall part, a curvilinear portion having a first radius of curvature and disposed adjacent to and contiguous with said second planar segment and an apex of said upper edge, said apex being curvilinear and having a second radius of curvature less than said first radius of curvature, said apex being contiguous with a generally planar wall portion extending substantially parallel to said outer wall part, an elongated lower edge of said panel including a downwardly projecting curvilinear tip portion contiguous with said outer wall part and a concave part of said lower edge formed by plural planar segments inclined with respect to said outer wall part at successively increasing acute angles of inclination with respect to said outer wall part, said upper and lower edges being cooperable with each other between adjacent interconnected panels to form a pinch resistant joint when said adjacent panels are pivoted relative to each other.

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21. The door set forth in claim 20 wherein:

said upper edge of said panel includes an inclined wall part extending between said generally planar and parallel wall portion and a first inner wall part joined thereto and said lower edge includes an inclined wall part extending between said concave part of said lower edge and a second inner wall part of said panel, said inclined wall parts forming a recess between adjacent panels for receiving plural hinge assemblies wherein said hinge assemblies are disposed substantially between said outer wall part and said inner wall parts of said panels, respectively.

22. The door set forth in claim 21 wherein:

said inner wall parts are integrally joined with said inclined wall parts of said upper and lower edges, respectively, and said inner wall parts are substantially coplanar and extend toward each other but leave a substantial gap therebetween.

23. The door set forth in claim 22 wherein:

said inner wall parts each include a groove formed therein and extending substantially normal to the plane of said inner wall parts, respectively, and each of said panels includes a reinforcing backer secured to said panel and extending between said inner wall parts to form a closed cavity within said panel between said outer wall part and said inner wall parts, said reinforcing backer including spaced apart flange portions adapted to be inserted in said grooves in said inner wall parts, respectively.

24. A sectional upward acting door including interconnectable door panels, said panels comprising generally planar rectangular members having respective upper and lower edges, said panels being adapted to be interconnected to each other by plural hinge assemblies spaced apart along and interconnecting adjacent ones of said panels and forming a pivot connection between adjacent panels, respectively, said hinge assemblies including opposed hinge plates adapted to be interconnected to each other by moving one panel adjacent to another panel, said hinge plates including cooperating parts which engage upon moving said one panel adjacent said another panel in one direction thereby pivotably connecting said panels, said cooperating parts preventing disengagement of said panels from each other during movement of said door between open and closed positions in a direction opposite said one direction.

25. The door set forth in claim 24 wherein:

at least selected ones of said panels include guide member support brackets mounted on structural members of said selected ones of said panels and being adapted to be connected to said selected ones of said panels, respectively, by moving said brackets into engagement with said selected ones of said panels.

26. The door set forth in claim 25 wherein:

each of said selected ones of said panels includes opposed structural stile members extending along opposed edges or said selected ones of said panels, said stile members including tab members formed thereon for engagement with a part of respective ones of said guide member support brackets whereby said guide member support brackets may be connected to a panel by sliding said guide member support brackets into engagement with said stile members, respectively.

27. The door set forth in claim 26 wherein:

said guide member support brackets include respective bosses formed thereon engageable with said stile members at said tab members for retaining said guide

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member support brackets connected to said selected ones of said panels, respectively.

28. The door set forth in claim **24** wherein:

said cooperating parts include, respectively, a hinge pin on one of said hinge plates, at least one bearing bore on the other of said hinge plates for receiving said hinge pin and an elastically deflectable retainer on said other hinge plate for retaining said hinge pin in said bearing bore in response to insertion of said hinge pin into said bearing bore.

29. The door set forth in claim **28** wherein:

said other hinge plate includes a web part, spaced apart flanges secured to said web part and extending generally parallel to each other, a bearing bore formed in each of said flanges and guide surfaces formed on each of said flanges for guiding distal ends of said hinge pin into said bearing bores.

30. The door set forth in claim **28** wherein:

said retainer on said other hinge plate includes opposed elastically deflectable fingers defining a gap therebetween for receiving said hinge pin for deflecting said fingers to allow forcible insertion of said hinge pin into said bearing bore, said fingers being elastically restorable to a position to retain said hinge pin in said bearing bore.

31. A method for assembling a sectional upward acting door wherein said door is operable to be supported for movement between open and closed positions between a pair of opposed spaced apart guide tracks, said door including plural, generally planar panel members adapted to be connected to each other along opposed edges of adjacent panel members and said door including plural hinge assemblies including, respectively, opposed hinge plates adapted to be connected to upper and lower edges of adjacent panels, respectively, and plural guide member support brackets also adapted to be connected to said panels, respectively, said method comprising the steps of:

placing a first panel between said guide tracks and connecting said first panel to said guide tracks;

placing a second panel between said guide tracks and adjacent to said first panel wherein an edge of said first panel is adjacent an edge of said second panel;

moving said panels toward each other to connect said panels by engaging said hinge plates of said hinge assemblies with each other, respectively; and

mounting at least two support brackets on said second panel with opposed guide members connected to said support brackets to support said second panel between said guide tracks.

32. The method set forth in claim **31** wherein:

the step of moving said panels toward each other comprises lowering said second panel into engagement with said first panel by interengaging said hinge plates of respective ones of said hinge assemblies with each other by moving said first and second panels relative to each other in a direction generally parallel to the longitudinal extent of said guide tracks.

33. The method set forth in claim **32** wherein:

the step of connecting said support brackets to said second panel comprises sliding said support brackets into engagement with said second panel at spaced apart bracket receiving tabs formed on structural members of said second panel, respectively.

34. A hinge assembly for interconnecting panels of a multipanel door, said hinge assembly comprising:

opposed hinge plates including means for mounting said hinge plates on adjacent panels of a multipanel door,

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respectively, a hinge pin on one of said hinge plates, at least one bearing bore on the other of said hinge plates for receiving said hinge pin in response to moving said one hinge plate toward said other hinge plate in one direction and an elastically deflectable retainer on said other hinge plate operable in response to engagement with said hinge pin during assembly of one panel of said door to an adjacent panel to deflect to provide for insertion of said hinge pin in said at least one bearing bore, said retainer being engageable with said hinge pin to prevent disengagement of said hinge plates from each other by any force applied through said hinge pin in a direction opposite said one direction during movement of said panels between door open and door closed positions.

35. The hinge assembly set forth in claim **34** wherein:

said other hinge plate includes a web part, spaced apart flanges secured to said web part and extending generally parallel to each other, a bearing bore formed in each of said flanges and guide surfaces formed on each of said flanges for guiding opposed distal ends of said hinge pin into said bearing bores, respectively.

36. The hinge assembly set forth in claim **35** wherein:

said retainer comprises an elastically deflectable tab formed on each of said flanges for retaining opposite ends of said hinge pin in said bearing bores, respectively.

37. The hinge assembly set forth in claim **34** wherein:

said other hinge plate includes opposed elastically deflectable fingers defining a gap therebetween for receiving said hinge pin for deflecting said fingers to allow forcible insertion of said hinge pin into said bearing bore, said fingers being elastically restorable to a position to retain said hinge pin in said bearing bore.

38. The hinge assembly set forth in claim **37** wherein:

said one hinge plate includes opposed parts engageable with said other hinge plate to prevent longitudinal displacement of said hinge plates relative to each other sufficient to disengage said hinge plates from each other in predetermined positions of said hinge plates with respect to each other.

39. The hinge assembly set forth in claim **37** wherein:

said hinge pin is integrally formed on said one hinge plate.

40. The hinge assembly set forth in claim **39** wherein:

said hinge pin is formed by opposed pin portions which are rolled in opposite directions to form a substantially cylindrical hinge pin integral with said one hinge plate.

41. A hinge assembly for interconnecting panels of a multi-panel door, said hinge assembly comprising:

opposed hinge plates including means for mounting said hinge plates, respectively, on adjacent panels of a multipanel door;

one of said hinge plates including an elongated hinge pin; the other of said hinge plates including a bearing part comprising opposed upstanding wall parts formed with opposed hinge pin retainer fingers inclined toward each other to form a slot opening toward a bearing bore for said hinge pin, said opposed fingers being elastically deflectable to allow said hinge pin of said one hinge plate to be moved in one direction into said bearing bore and said fingers being characterized such that, upon said hinge pin of said one hinge plate passing through said slot, said fingers are operable to retain said hinge plates connected to each other and said fingers are not operable to be deflected by any force applied through said hinge pin to allow removal of said hinge

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pin from said bearing bore by urging said hinge pin in a direction opposite said one direction.

42. The hinge assembly set forth in claim **41** wherein:

said one hinge plate includes opposed spaced apart parts engageable with said other hinge plate to prevent separation of said hinge plates from each other in a direction generally along a longitudinal axis of said hinge pin in selected predetermined positions of said hinge plates with respect to each other.

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43. The hinge assembly set forth in claim **41** wherein: said hinge pin is integrally formed on said one hinge plate.

44. The hinge assembly set forth in claim **43** wherein:

said hinge pin is formed by opposed pin portions which are rolled in opposite directions to form a substantially cylindrical hinge pin integral with said one hinge plate.

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